Import the required libraries

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

Get the train data

Since pandas is a bit slow in reading the 55 million rows of data from the train dataset, i began by generating a random sample dataset which is 20% of the original data set (about 11,000,000 rows)

In [2]:
```
New_York_Fair_train = pd.read_csv('TrainRandomSample(20%).csv')
```

```
C:\Users\HP\anaconda3\lib\site-packages\IPython\core\interactiveshell.py:3165: DtypeWarning: Columns (5,6) have
mixed types.Specify dtype option on import or set low_memory=False.
  has_raised = await self.run_ast_nodes(code_ast.body, cell_name,
```

In [3]:
```
New_York_Fair_train.head()
```

Out[3]:

	key	fare_amount	pickup_datetime	pickup_longitude	pickup_latitude	dropoff_longitude	dropoff_latitude	passenger_count
0	2009-06-15 17:26:21.0000001	4.5	2009-06-15 17:26:21 UTC	-73.844311	40.721319	-73.84161	40.712278	1
1	2010-01-09 07:51:00.000000135	5.3	2010-01-09 07:51:00 UTC	-73.968095	40.768008	-73.956655	40.783762	1
2	2012-12-03 13:10:00.000000125	9.0	2012-12-03 13:10:00 UTC	-74.006462	40.726713	-73.993078	40.731628	1
3	2009-09-02 01:11:00.000000083	8.9	2009-09-02 01:11:00 UTC	-73.980658	40.733873	-73.99154	40.758138	2
4	2012-04-08 07:30:50.0000002	5.3	2012-04-08 07:30:50 UTC	-73.996335	40.737142	-73.980721	40.733559	1

Data manipulation and cleaning

View the number of rows and columns that the data has

In [4]:
```
New_York_Fair_train.shape
```

Out[4]:
```
(11085890, 8)
```

View the data types of the data in the various columns

In [5]:
```
New_York_Fair_train.dtypes
```

Out[5]:
```
key                 object
fare_amount        float64
pickup_datetime     object
pickup_longitude   float64
pickup_latitude    float64
dropoff_longitude   object
dropoff_latitude    object
passenger_count      int64
dtype: object
```

Drop the rows with zero entries in the dropoff_latitude and Dropoff_longitude columns

In [6]:
```
New_York_Fair_train = New_York_Fair_train.loc[(New_York_Fair_train['dropoff_longitude', 'dropoff_latitude']) !
```

Verify that the rows have been dropped

In [7]:
```
New_York_Fair_train.shape
```

Out[7]:
```
(10946938, 8)
```

Drop off the unwanted columns (Key & pickup-datetime)

In [8]:
```
New_York_Fair_train = New_York_Fair_train.drop(['key', 'pickup_datetime'], axis=1)
```

Verify that the columns have been dropped.

In [9]:
```
New_York_Fair_train.columns
```

Out[9]:
```
Index(['fare_amount', 'pickup_longitude', 'pickup_latitude',
       'dropoff_longitude', 'dropoff_latitude', 'passenger_count'],
      dtype='object')
```

Check the datatypes of the remaining columns

In [10]:
```
New_York_Fair_train.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 10946938 entries, 0 to 11085889
Data columns (total 6 columns):
 #   Column             Dtype
---  ------             -----
 0   fare_amount        float64
 1   pickup_longitude   float64
 2   pickup_latitude    float64
 3   dropoff_longitude  object
 4   dropoff_latitude   object
 5   passenger_count    int64
dtypes: float64(3), int64(1), object(2)
memory usage: 584.6+ MB
```

Convert the object datatypes to numeric datatypes

In [11]:
```
New_York_Fair_train['dropoff_longitude'] = pd.to_numeric(New_York_Fair_train['dropoff_longitude'], errors = 'co
```

In [12]:
```
New_York_Fair_train['dropoff_latitude'] = pd.to_numeric(New_York_Fair_train['dropoff_latitude'], errors = 'coer
```

Confirm the conversion

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

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 10946938 entries, 0 to 11085889
Data columns (total 6 columns):
 #   Column             Dtype
---  ------             -----
 0   fare_amount        float64
 1   pickup_longitude   float64
 2   pickup_latitude    float64
 3   dropoff_longitude  float64
 4   dropoff_latitude   float64
 5   passenger_count    int64
dtypes: float64(5), int64(1)
memory usage: 584.6 MB
```

Check if the dataset has null values

In [14]:
```
New_York_Fair_train.isna().sum(axis=0)
```

Out[14]:
```
fare_amount          0
pickup_longitude     0
pickup_latitude      0
dropoff_longitude    77
dropoff_latitude     77
passenger_count      0
dtype: int64
```

Drop the rows with null values

In [15]:
```
New_York_Fair_train = New_York_Fair_train.dropna()
```

Confirm that the nulls have been dropped

In [16]:
```
New_York_Fair_train.isna().sum(axis=0)
```

Out[16]:
```
fare_amount          0
pickup_longitude     0
pickup_latitude      0
dropoff_longitude    0
dropoff_latitude     0
passenger_count      0
dtype: int64
```

Check for duplicates in the dataset

In [17]:
```
New_York_Fair_train.duplicated().sum()
```

Out[17]:
```
72536
```

Drop the duplicates

In [18]:
```
New_York_Fair_train = New_York_Fair_train.drop_duplicates()
```

In [19]:
```
# Confirm that the duplicates were dropped
New_York_Fair_train.duplicated().sum()
```

Out[19]:
```
0
```

In [20]:
```
New_York_Fair_train.head()
```

Out[20]:

	fare_amount	pickup_longitude	pickup_latitude	dropoff_longitude	dropoff_latitude	passenger_count
0	4.5	-73.844311	40.721319	-73.841610	40.712278	1
1	5.3	-73.968095	40.768008	-73.956655	40.783762	1
2	9.0	-74.006462	40.726713	-73.993078	40.731628	1
3	8.9	-73.980658	40.733873	-73.991540	40.758138	2
4	5.3	-73.996335	40.737142	-73.980721	40.733559	1

Display the descriptive summary of the Fare_amounts

In [21]:
```
New_York_Fair_train['fare_amount'].describe()
```

Out[21]:
```
count    1.087432e+07
mean     1.133677e+01
std      9.758028e+00
min     -3.000000e+02
25%      6.000000e+00
50%      8.500000e+00
75%      1.250000e+01
max      2.010990e+03
Name: fare_amount, dtype: float64
```

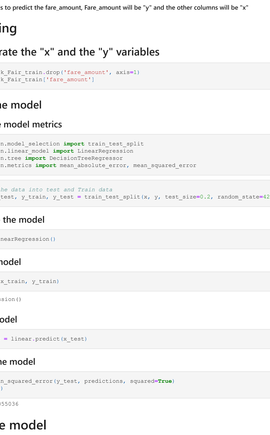
Check the correlation by generating a correlation matrix

In [22]:
```
corr_matrix = New_York_Fair_train.corr()
```

Visualize the matrix

In [23]:
```
plt.figure(figsize=(12,8))
sns.heatmap(corr_matrix, annot = True, cmap='inferno')
```

Out[23]:
```
<AxesSubplot:>
```



Since the goal is to predict the fare_amount, Fare_amount will be "y" and the other columns will be "x"

Modelling

We separate the "x" and the "y" variables

In [24]:
```
x = New_York_Fair_train.drop('fare_amount', axis=1)
y = New_York_Fair_train['fare_amount']
```

Create the model

Import the model metrics

In [25]:
```
from sklearn.model_selection import train_test_split
from sklearn.linear_model import LinearRegression
from sklearn.tree import DecisionTreeRegressor
from sklearn.metrics import mean_absolute_error, mean_squared_error
```

In [26]:
```
### Split the data into test and Train data
x_train, x_test, y_train, y_test = train_test_split(x, y, test_size=0.2, random_state=42)
```

Instantiate the model

In [27]:
```
linear = LinearRegression()
```

Train the model

In [28]:
```
linear.fit(x_train, y_train)
```

Out[28]:
```
LinearRegression()
```

Test the model

In [29]:
```
predictions = linear.predict(x_test)
```

Evaluate the model

In [30]:
```
error = mean_squared_error(y_test, predictions, squared=True)
print(error)
```

```
95.55216833055036
```

save the model

In [31]:
```
import joblib
```

In [32]:
```
joblib.dump(linear, 'regression.pkl')
```

Out[32]:
```
['regression.pkl']
```

In [33]:
```
New_York_Fair_train.columns
```

Out[33]:
```
Index(['fare_amount', 'pickup_longitude', 'pickup_latitude',
       'dropoff_longitude', 'dropoff_latitude', 'passenger_count'],
      dtype='object')
```

In [ ]:
```

```