Loading libraries

In [1]:

```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import warnings
warnings.filterwarnings('ignore')
from haversine import haversine
import seaborn as sns
```

In [2]:

```
#pip install haversine
```

Loading Dataset & Performing EDA

In [3]:

```
data_new=pd.read_csv("C:/Users/AYRUS/Desktop/nyc_taxi_trip_duration.csv")
```

In [4]:

```
data_new.head()
```

Out[4]:

	id	vendor_id	pickup_datetime	dropoff_datetime	passenger_count	pickup_longitude	pi
0	id1080784	2	2016-02-29 16:40:21	2016-02-29 16:47:01	1	-73.953918	
1	id0889885	1	2016-03-11 23:35:37	2016-03-11 23:53:57	2	-73.988312	
2	id0857912	2	2016-02-21 17:59:33	2016-02-21 18:26:48	2	-73.997314	
3	id3744273	2	2016-01-05 09:44:31	2016-01-05 10:03:32	6	-73.961670	
4	id0232939	1	2016-02-17 06:42:23	2016-02-17 06:56:31	1	-74.017120	

In [5]:

```
data_new.columns
```

Out[5]:

```
Index(['id', 'vendor_id', 'pickup_datetime', 'dropoff_datetime',
       'passenger_count', 'pickup_longitude', 'pickup_latitude',
       'dropoff_longitude', 'dropoff_latitude', 'store_and_fwd_flag',
       'trip_duration'],
      dtype='object')
```

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

Out[6]:
```
id                     object
vendor_id               int64
pickup_datetime        object
dropoff_datetime       object
passenger_count         int64
pickup_longitude      float64
pickup_latitude       float64
dropoff_longitude     float64
dropoff_latitude      float64
store_and_fwd_flag     object
trip_duration           int64
dtype: object
```

In [7]:
```
data_new.isnull().sum()
```

Out[7]:
```
id                    0
vendor_id             0
pickup_datetime       0
dropoff_datetime      0
passenger_count       0
pickup_longitude      0
pickup_latitude       0
dropoff_longitude     0
dropoff_latitude      0
store_and_fwd_flag    0
trip_duration         0
dtype: int64
```

In [8]:
```
data_new.nunique()
```

Out[8]:
```
id                    729322
vendor_id                  2
pickup_datetime       709359
dropoff_datetime      709308
passenger_count            9
pickup_longitude       19729
pickup_latitude        39776
dropoff_longitude      27892
dropoff_latitude       53579
store_and_fwd_flag         2
trip_duration           6296
dtype: int64
```

In [9]:
```
data_new.passenger_count.value_counts()
```

Out[9]:
```
1    517415
2    105097
5     38926
3     29692
6     24107
4     14050
0        33
7         1
9         1
Name: passenger_count, dtype: int64
```

In [10]:
```
data=data_new[data_new['passenger_count']!=0]
data=data_new[data_new['passenger_count']<=6]
```

In [11]:
```
data.passenger_count.value_counts()
```

Out[11]:
```
1    517415
2    105097
5     38926
3     29692
6     24107
4     14050
0        33
Name: passenger_count, dtype: int64
```

In [12]:
```
data['trip_duration'].sort_values(ascending=False)
```

Out[12]:
```
21813     1939736
259437      86391
119185      86387
177225      86378
496391      86377
           ...   
102646          1
672240          1
398887          1
95823           1
312992          1
Name: trip_duration, Length: 729320, dtype: int64
```

In [13]:
```
data.drop(data[data['trip_duration']==1939736].index,inplace=True)
```

In [14]:
```
data.describe()
```

Out[14]:

	vendor_id	passenger_count	pickup_longitude	pickup_latitude	dropoff_longitude	dropo
count	729319.000000	729319.000000	729319.000000	729319.000000	729319.000000	7293
mean	1.535402	1.662038	-73.973513	40.750919	-73.973422	
std	0.498745	1.312405	0.069753	0.033594	0.069587	
min	1.000000	0.000000	-121.933342	34.712234	-121.933304	
25%	1.000000	1.000000	-73.991859	40.737335	-73.991318	
50%	2.000000	1.000000	-73.981758	40.754070	-73.979759	
75%	2.000000	2.000000	-73.967361	40.768314	-73.963036	
max	2.000000	6.000000	-65.897385	51.881084	-65.897385	

In [15]:
```
data.shape
```

Out[15]:
```
(729319, 11)
```

In [16]:
```
# Converting vendor_id and store_and_fwd_flag as category
data['vendor_id']=data['vendor_id'].astype('category')
data['store_and_fwd_flag']=data['store_and_fwd_flag'].astype('category')
```

In [17]:
```
# Converting pickup_datetime and dropoff_datetime in datetime format
data['pickup_datetime']=pd.to_datetime(data['pickup_datetime'],format='%Y-%m-%d %
data['dropoff_datetime']=pd.to_datetime(data['dropoff_datetime'],format='%Y-%m-%d
```

In [18]:
```
data.dtypes
```

Out[18]:
```
id                            object
vendor_id                   category
pickup_datetime       datetime64[ns]
dropoff_datetime      datetime64[ns]
passenger_count                int64
pickup_longitude             float64
pickup_latitude              float64
dropoff_longitude            float64
dropoff_latitude             float64
store_and_fwd_flag          category
trip_duration                  int64
dtype: object
```

In [19]:
```
# Creating new column and storing hour value
data['pickup_hour']=data['pickup_datetime'].dt.hour
```

In [20]:

```
# Creating new column and storing pickup time of day value
data['pick_time_of_the_day']=data.pickup_hour.apply(lambda y:(y%24+4)//4).replace
```

In [21]:

```
# Creating new day_of_the_week column which stores the day of week
data['day_of_the_week']=data.pickup_datetime.apply(lambda x:x.day_name())
```

In [22]:

```
# Converting  trip duration in hours to second
data['trip_duration_in_hours']=data.trip_duration.apply(lambda x: x/3600)
```

In [23]:

```
#Transforming day of week - Monday (0) to Sunday (6)
data['pickup_day_of_week']=data['pickup_datetime'].dt.dayofweek
```

In [24]:

```
#Transforming pick up time of the day
condition=[data['pick_time_of_the_day']=='Late Night',
           data['pick_time_of_the_day']=='Early Morning',
           data['pick_time_of_the_day']=='Morning',
           data['pick_time_of_the_day']=='Afternoon',
           data['pick_time_of_the_day']=='Evening',
           data['pick_time_of_the_day']=='Night']

choice=[0,1,2,3,4,5]

data['pick_time_of_the_day_in_numbers']=np.select(condition,choice)
```

In [25]:

```
# define a function to calculate distance
def calc_distance(df):
    pickup = (df['pickup_latitude'], df['pickup_longitude'])
    drop = (df['dropoff_latitude'], df['dropoff_longitude'])
    return haversine(pickup, drop)
```

In [26]:

```
# creating a new column to store the distance value
data['total_distance'] = data.apply(lambda x: calc_distance(x), axis = 1)
```

In [27]:

```
# calculating speed
data['speed'] = (data.total_distance/(data.trip_duration/3600))
```

In [28]:
```
data.head()
```

Out[28]:

	id	vendor_id	pickup_datetime	dropoff_datetime	passenger_count	pickup_longitude	pi
0	id1080784	2	2016-02-29 16:40:21	2016-02-29 16:47:01	1	-73.953918	
1	id0889885	1	2016-03-11 23:35:37	2016-03-11 23:53:57	2	-73.988312	
2	id0857912	2	2016-02-21 17:59:33	2016-02-21 18:26:48	2	-73.997314	
3	id3744273	2	2016-01-05 09:44:31	2016-01-05 10:03:32	6	-73.961670	
4	id0232939	1	2016-02-17 06:42:23	2016-02-17 06:56:31	1	-74.017120	

In [29]:
```
# Creating a dataframe to use for regression
data_features=['vendor_id','passenger_count','pickup_day_of_week','pick_time_of_t
```

In [30]:
```
nyc_data=data[data_features]
nyc_data.head()
```

Out[30]:

	vendor_id	passenger_count	pickup_day_of_week	pick_time_of_the_day_in_numbers	trip_duratio
0	2	1	0	4	
1	1	2	4	5	
2	2	2	6	4	
3	2	6	1	2	
4	1	1	2	1	

Segragating variables Independent and Dependent

In [31]:
```
# seprating independent and dependent variables
x=nyc_data.drop(['trip_duration_in_hours'],axis=1)
y=data['trip_duration_in_hours']

x.shape , y.shape
```

Out[31]:
```
((729319, 6), (729319,))
```

Importing train test split

In [32]:

```
# Importing Train test split
from sklearn.model_selection import train_test_split
train_x,test_x,train_y,test_y=train_test_split(x,y,random_state=56)
```

Importing Linear Regression & Mean Absolute Error

In [33]:

```
from sklearn.linear_model import LinearRegression as LR
from sklearn.metrics import mean_absolute_error as mae
```

In [34]:

```
# Creating instance of Linear Regresssion
lr=LR()
lr.fit(train_x,train_y)
```

Out[34]:

```
LinearRegression()
```

In [35]:

```
#  Predicting over the Train Set and calculating error
train_predict = lr.predict(train_x)
k1 = mae(train_predict, train_y)
print('Training Mean Absolute Error', k1)
```

```
Training Mean Absolute Error 0.09736722896266335
```

In [36]:

```
# Predicting over the Test Set and calculating error
test_predict = lr.predict(test_x)
k2 = mae(test_predict, test_y)
print('Test Mean Absolute Error    ', k2 )
```

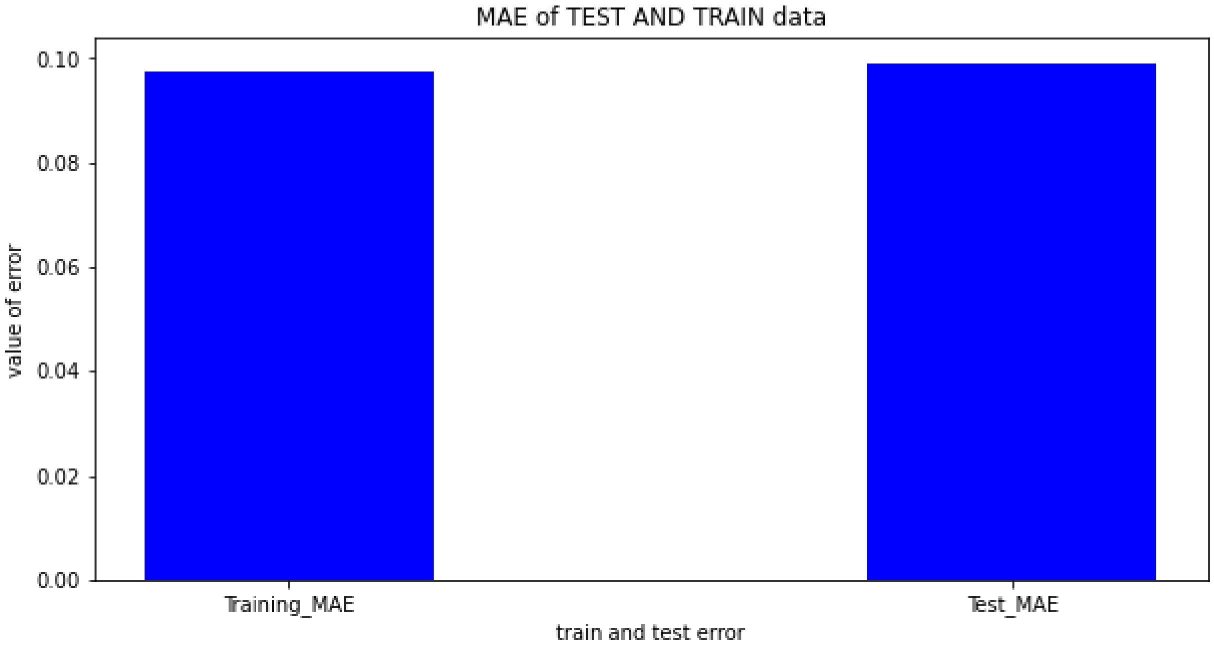
```
Test Mean Absolute Error     0.09902506089335923
```

In [37]:

```
# creating data for bar plot
create_data={'Training_MAE':k1,
             'Test_MAE':k2}

display=list(create_data.keys())
value=list(create_data.values())

fig = plt.figure(figsize = (10, 5))

# creating the bar plot
plt.bar(display, value, color ='blue',
        width = 0.4)

plt.xlabel("train and test error")
plt.ylabel("value of error")
plt.title("MAE of TEST AND TRAIN data")
plt.show
```

Out[37]:

```
<function matplotlib.pyplot.show(close=None, block=None)>
```



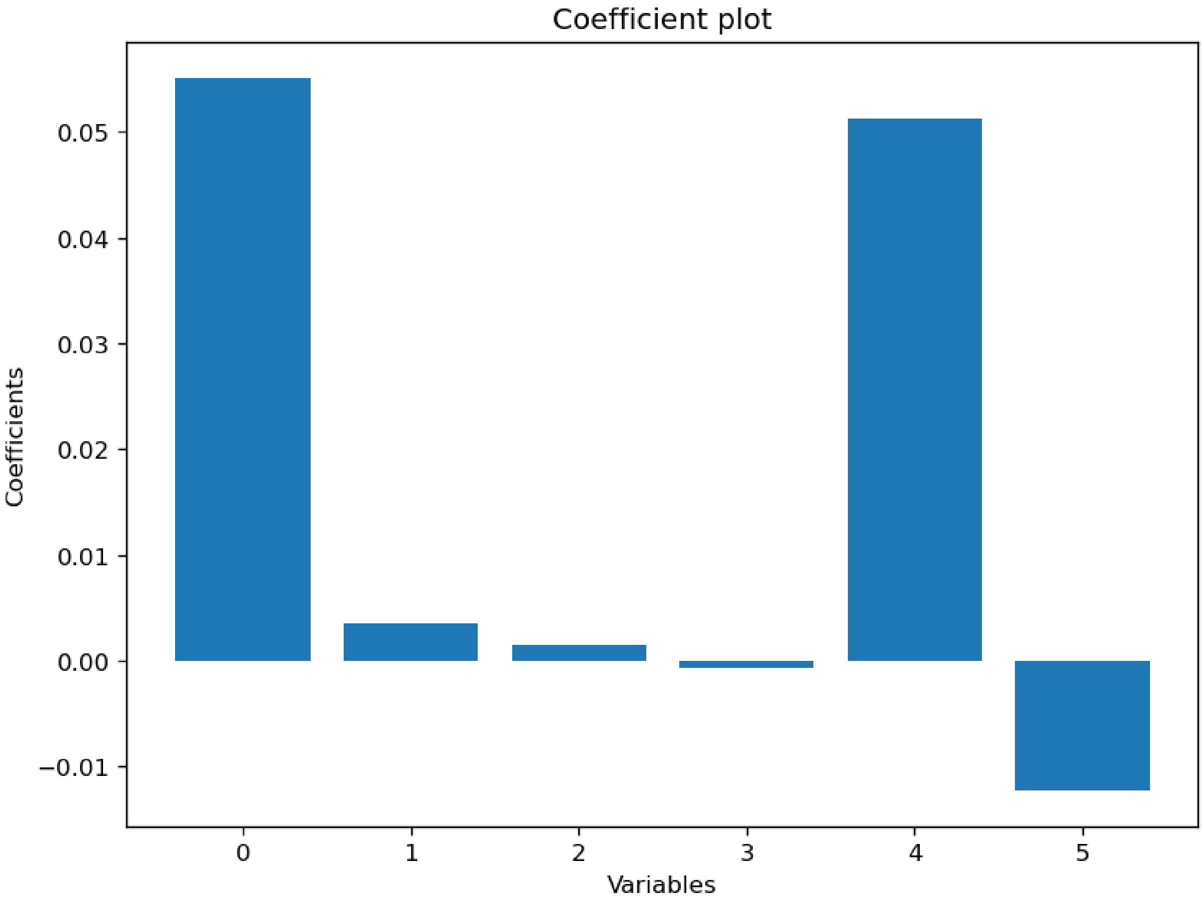
In [38]:

```
lr.coef_
```

Out[38]:

```
array([ 0.05510897,  0.00350898,  0.00146914, -0.00071647,  0.05121949,
       -0.01225439])
```

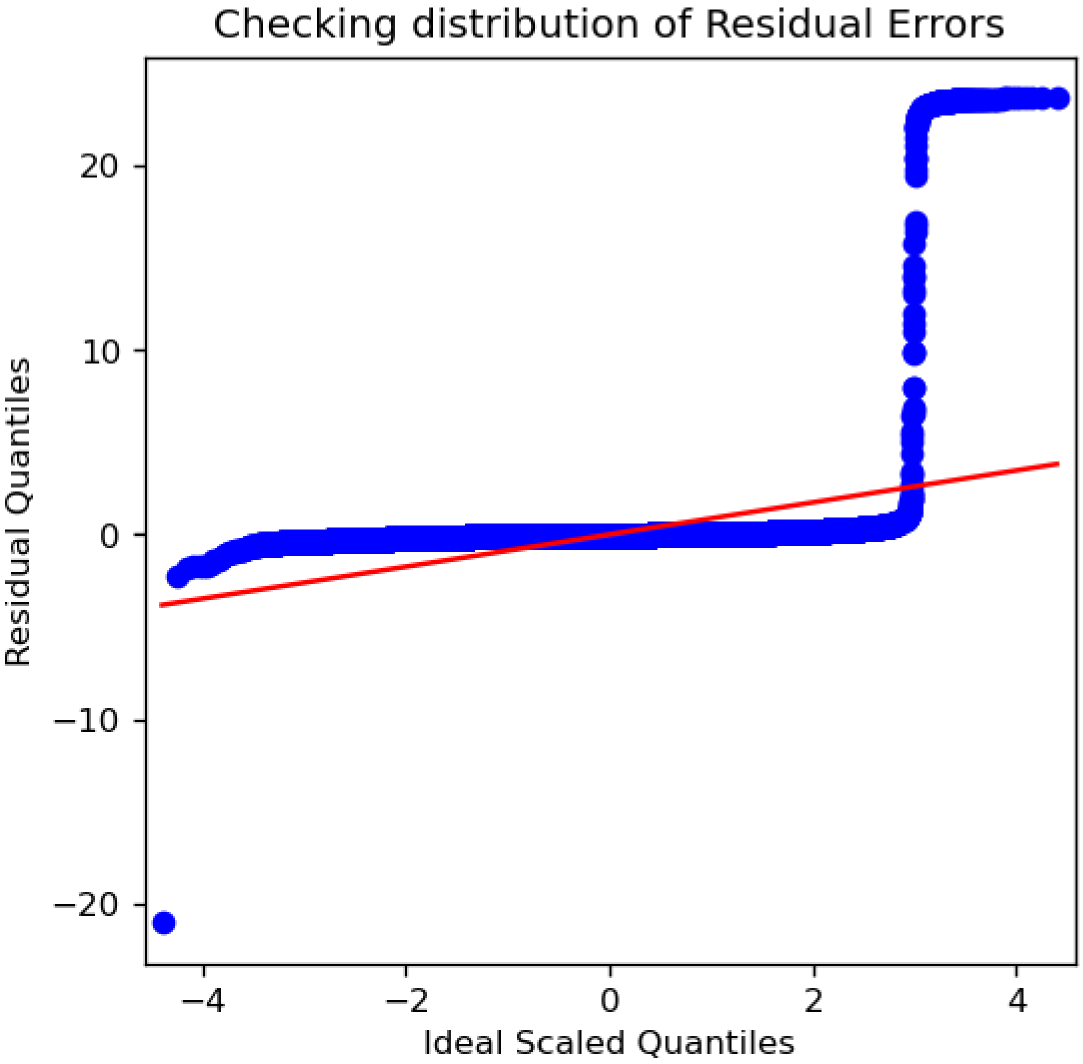
In [39]:
```
plt.figure(figsize=(8, 6), dpi=120, facecolor='w', edgecolor='b')
x = range(len(train_x.columns))
y = lr.coef_
plt.bar( x, y )
plt.xlabel( "Variables")
plt.ylabel('Coefficients')
plt.title('Coefficient plot');
```



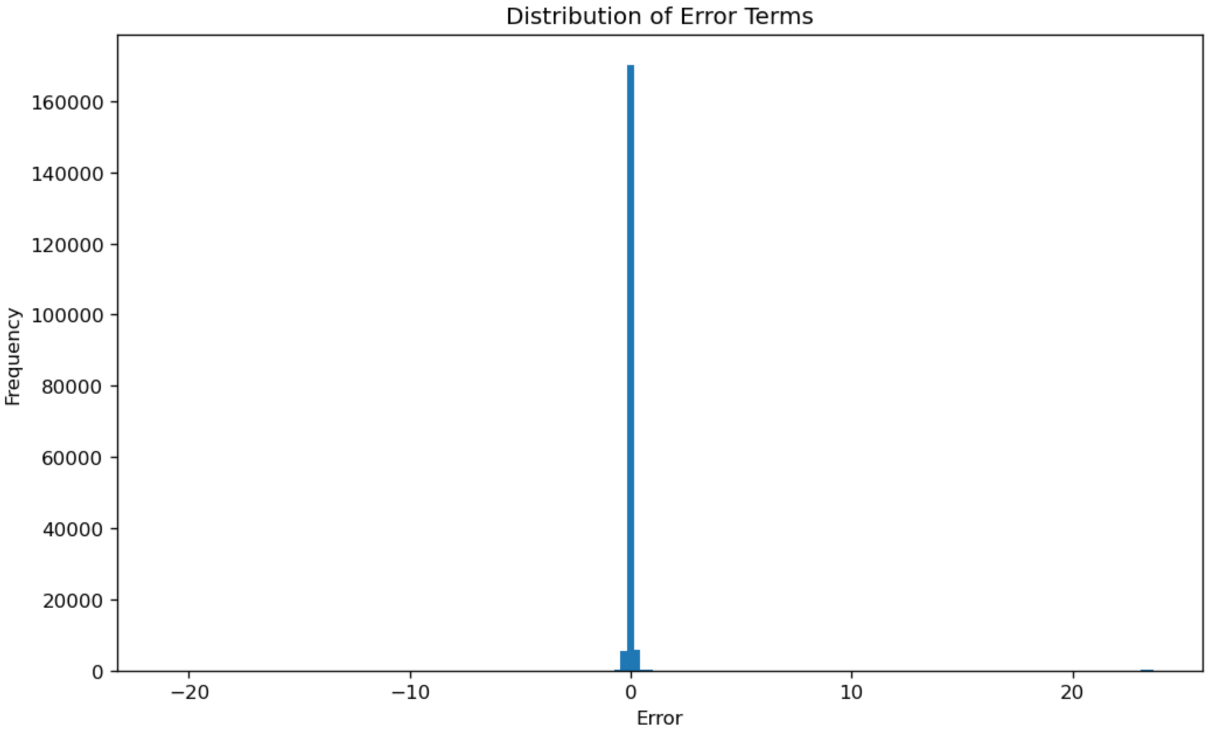
In [40]:
```
# calculating the Residuals
residuals = pd.DataFrame({
    'fitted values' : test_y,
    'predicted values' : test_predict,
})

residuals['residuals'] = residuals['fitted values'] - residuals['predicted values
residuals.head()
```

Out[40]:
```
        fitted values  predicted values  residuals
14908        0.668333          0.872062  -0.203728
223798       0.025278          0.177354  -0.152076
582522       0.049167          0.034962   0.014204
382010       0.133333          0.243796  -0.110463
619443       0.209722          0.222530  -0.012807
```

In [41]:
```
# Importing qqplot
from statsmodels.graphics.gofplots import qqplot

## Plotting the QQ plot
fig, ax = plt.subplots(figsize=(5,5) , dpi = 120)
qqplot(residuals.residuals, line = 's' , ax = ax)
plt.ylabel('Residual Quantiles')
plt.xlabel('Ideal Scaled Quantiles')
plt.title('Checking distribution of Residual Errors')
plt.show()
```



In [42]:
```
plt.figure(figsize=(10, 6), dpi=120, facecolor='w', edgecolor='b')
plt.hist(residuals.residuals, bins = 150)
plt.xlabel('Error')
plt.ylabel('Frequency')
plt.title('Distribution of Error Terms')
plt.show()
```



Importing ridge

In [43]:
```
from sklearn.linear_model import Ridge
m = Ridge(alpha=0.01)
m.fit(train_x,train_y)
Ridge_train_score=m.score(train_x,train_y)
```

In [44]:

```
# getting train score
Ridge_train_score
```

Out[44]:

```
0.04641383298644963
```

Type *Markdown* and LaTeX: α^2

In [ ]:

In [ ]:

In [ ]:

In [ ]: