```
#Importing the required libraries
import pandas as pd
import numpy as np
import seaborn as sns
import matplotlib.pyplot as plt
import datetime
```

```
#importing the dataset
df= pd.read_csv("/content/uber.csv")
```

1. Pre-process the dataset.

```
df.head()
```

	Unnamed: 0	key	fare_amount	pickup_datetime	pickup_longitude	pickup_latitude	dropoff_longitude	dropoff_latitude
0	24238194	2015-05-07 19:52:06.0000003	7.5	2015-05-07 19:52:06 UTC	-73.999817	40.738354	-73.999512	40.723217
1	27835199	2009-07-17 20:04:56.0000002	7.7	2009-07-17 20:04:56 UTC	-73.994355	40.728225	-73.994710	40.750325
2	44984355	2009-08-24 21:45:00.00000061	12.9	2009-08-24 21:45:00 UTC	-74.005043	40.740770	-73.962565	40.772647
3	25894730	2009-06-26 08:22:21.0000001	5.3	2009-06-26 08:22:21 UTC	-73.976124	40.790844	-73.965316	40.803349
4	17610152	2014-08-28 17:47:00.000000188	16.0	2014-08-28 17:47:00 UTC	-73.925023	40.744085	-73.973082	40.761247

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```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 80416 entries, 0 to 80415
Data columns (total 9 columns):
 #   Column             Non-Null Count  Dtype  
---  ------             --------------  -----  
 0   Unnamed: 0         80416 non-null  int64  
 1   key                80416 non-null  object 
 2   fare_amount        80416 non-null  float64
 3   pickup_datetime    80416 non-null  object 
 4   pickup_longitude   80416 non-null  float64
 5   pickup_latitude    80416 non-null  float64
 6   dropoff_longitude  80416 non-null  float64
 7   dropoff_latitude   80415 non-null  float64
 8   passenger_count    80415 non-null  float64
dtypes: float64(6), int64(1), object(2)
memory usage: 5.5+ MB
```

```
df.columns #TO get number of columns in the dataset
```

```
Index(['Unnamed: 0', 'key', 'fare_amount', 'pickup_datetime',
       'pickup_longitude', 'pickup_latitude', 'dropoff_longitude',
       'dropoff_latitude', 'passenger_count'],
      dtype='object')
```

```
df =df.drop(['Unnamed: 0', 'key'], axis= 1) #To drop unnamed column
```

```
df.head()
```

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				pickup_latitude	dropoff_longitude	dropoff_latitude	passenger_count
0	7.5	2015-05-07 19:52:06 UTC	-73.999817	40.738354	-73.999512	40.723217	1.0
1	7.7	2009-07-17 20:04:56 UTC	-73.994355	40.728225	-73.994710	40.750325	1.0
2	12.9	2009-08-24 21:45:00 UTC	-74.005043	40.740770	-73.962565	40.772647	1.0
3	5.3	2009-06-26 08:22:21 UTC	-73.976124	40.790844	-73.965316	40.803349	3.0
4	16.0	2014-08-28 17:47:00 UTC	-73.925023	40.744085	-73.973082	40.761247	5.0

```
df.shape
#To get the total (Rows,Columns)
```

```
(80416, 7)
```

```
df.dtypes
#To get the type of each column
```

```
fare_amount          float64
pickup_datetime       object
pickup_longitude     float64
pickup_latitude      float64
dropoff_longitude    float64
dropoff_latitude     float64
passenger_count      float64
dtype: object
```

```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 80416 entries, 0 to 80415
Data columns (total 7 columns):
 #   Column             Non-Null Count  Dtype
---  ------             --------------  -----
 0   fare_amount        80416 non-null  float64
 1   pickup_datetime    80416 non-null  object
 2   pickup_longitude   80416 non-null  float64
 3   pickup_latitude    80416 non-null  float64
 4   dropoff_longitude  80416 non-null  float64
 5   dropoff_latitude   80415 non-null  float64
```

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```
memory usage: 4.3+ MB
```

```
df.describe() #To get statistics of each columns
```

	fare_amount	pickup_longitude	pickup_latitude	dropoff_longitude	dropoff_latitude	passenger_count
count	80416.000000	80416.000000	80416.000000	80416.000000	80415.000000	80415.000000
mean	11.381542	-72.533096	39.945845	-72.567713	39.934459	1.674874
std	9.924870	11.857315	8.557173	15.738776	6.803074	1.295577
min	-5.000000	-1340.648410	-74.015515	-3356.666300	-74.009465	0.000000
25%	6.000000	-73.992020	40.734812	-73.991417	40.733664	1.000000
50%	8.500000	-73.981775	40.752595	-73.980082	40.752982	1.000000
75%	12.500000	-73.967171	40.767118	-73.963773	40.768112	2.000000
max	350.000000	40.808425	1644.421482	40.828672	872.697628	6.000000

2. Filling Missing values

```
df.isnull().sum()
```

```
fare_amount          0
pickup_datetime      0
pickup_longitude     0
pickup_latitude      0
dropoff_longitude    0
dropoff_latitude     1
passenger_count      1
dtype: int64
```

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

```
df.isnull().sum()
```

```
     fare_amount          0
     pickup_datetime      0
     pickup_longitude     0
     pickup_latitude      0
     dropoff_longitude    0
     dropoff_latitude     0
     passenger_count      0
     dtype: int64
```

```
df.dtypes
```

```
     fare_amount          float64
     pickup_datetime       object
     pickup_longitude     float64
     pickup_latitude      float64
     dropoff_longitude    float64
     dropoff_latitude     float64
     passenger_count      float64
     dtype: object
```

```
df['pickup_datetime']
```

```
     0         2015-05-07 19:52:06 UTC
     1         2009-07-17 20:04:56 UTC
     2         2009-08-24 21:45:00 UTC
     3         2009-06-26 08:22:21 UTC
     4         2014-08-28 17:47:00 UTC
```

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```
     80412    2009-04-02 14:35:00 UTC
     80413    2013-05-29 15:25:23 UTC
     80414    2011-11-17 14:49:35 UTC
     80415    2011-11-01 02:33:26 UTC
     Name: pickup_datetime, Length: 80416, dtype: object
```

Date is in incorrct format

```
df.pickup_datetime=pd.to_datetime(df.pickup_datetime,errors='coerce')
```

```
df.dtypes
```

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

To seperate each time of date and time

```
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()
```

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				_latitude	dropoff_longitude	dropoff_latitude	passenger_count	hour	day	m
0	7.5	19:52:06+00:00	-73.999817	40.738354	-73.999512	40.723217	1.0	19	7	
1	7.7	2009-07-17 20:04:56+00:00	-73.994355	40.728225	-73.994710	40.750325	1.0	20	17	
2	12.9	2009-08-24 21:45:00+00:00	-74.005043	40.740770	-73.962565	40.772647	1.0	21	24	
3	5.3	2009-06-26 08:22:21+00:00	-73.976124	40.790844	-73.965316	40.803349	3.0	8	26	
4	16.0	2014-08-28 17:47:00+00:00	-73.925023	40.744085	-73.973082	40.761247	5.0	17	28	

```
# drop the column 'pickup_daetime' using drop() # 'axis = 1' drops the specified column
df = df.drop('pickup_datetime',axis=1)
```

```
df.head()
```

	fare_amount	pickup_longitude	pickup_latitude	dropoff_longitude	dropoff_latitude	passenger_count	hour	day	month	year	dayof
0	7.5	-73.999817	40.738354	-73.999512	40.723217	1.0	19	7	5	2015	
1	7.7	-73.994355	40.728225	-73.994710	40.750325	1.0	20	17	7	2009	
2	12.9	-74.005043	40.740770	-73.962565	40.772647	1.0	21	24	8	2009	
3	5.3	-73.976124	40.790844	-73.965316	40.803349	3.0	8	26	6	2009	
4	16.0	-73.925023	40.744085	-73.973082	40.761247	5.0	17	28	8	2014	

```
df.dtypes
```

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

Checking outliers and filling them

```
df.plot(kind = "box",
        subplots = True,
        layout = (4,3),
        figsize=(12,8)) #Boxplot to check
```

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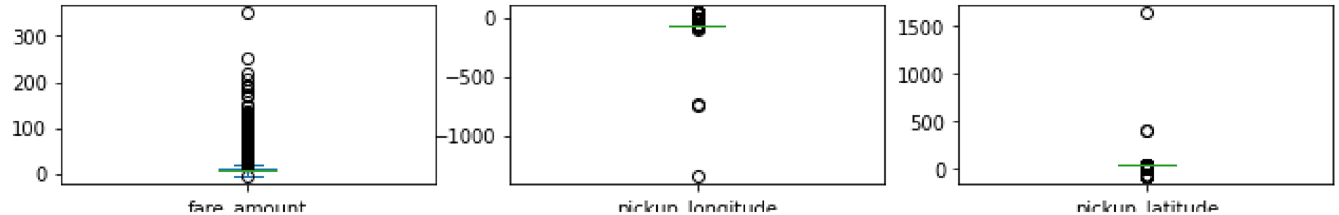
```
                                                       41x0.16413)
                                                       41x0.16413)
                                                       41x0.16413)
    dropoff_longitude         AxesSubplot(0.125,0.518913;0.227941x0.16413)
    dropoff_latitude       AxesSubplot(0.398529,0.518913;0.227941x0.16413)
    passenger_count        AxesSubplot(0.672059,0.518913;0.227941x0.16413)
    hour                      AxesSubplot(0.125,0.321957;0.227941x0.16413)
    day                    AxesSubplot(0.398529,0.321957;0.227941x0.16413)
    month                  AxesSubplot(0.672059,0.321957;0.227941x0.16413)
    year                         AxesSubplot(0.125,0.125;0.227941x0.16413)
    dayofweek                 AxesSubplot(0.398529,0.125;0.227941x0.16413)
    dtype: object
```



```
#Using the InterQuartile Range to fill the values
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
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))
```

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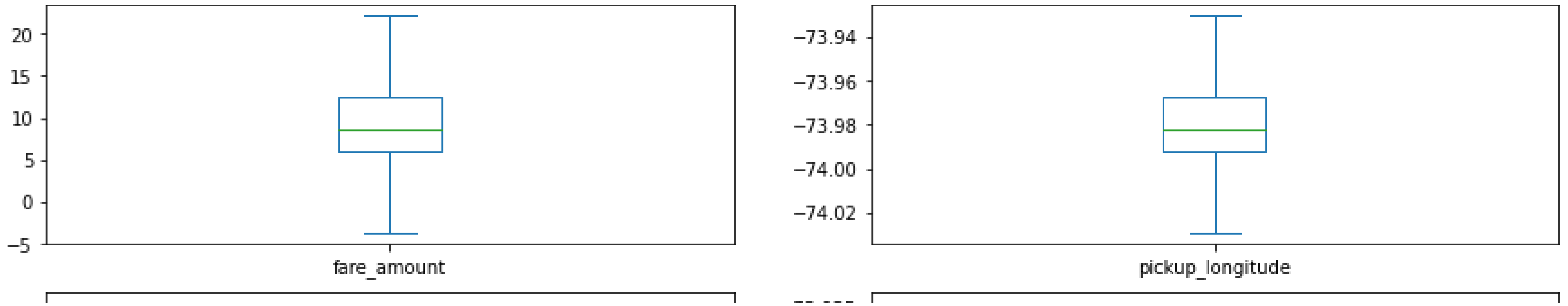
```
                                                   73x0.0920732)
                                                   73x0.0920732)
                                                   73x0.0920732)
    dropoff_longitude    AxesSubplot(0.547727,0.677439;0.352273x0.0920732)
    dropoff_latitude        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
```



```
!pip install haversine
import haversine as hs  #Calculate the distance using Haversine to calculate the dista
travel_dist = []
for pos in range(len(df['pickup_longitude'])):
  long1,lati1,long2,lati2 = [
      df['pickup_longitude'][pos],
      df['pickup_latitude'][pos],
      df['dropoff_longitude'][pos],
      df['dropoff_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()
```

To undo cell deletion use Ctrl+M Z or the Undo option in the Edit menu ✕

```
ython.pkg.dev/colab-wheels/public/simple/
3)
Installing collected packages: haversine
Successfully installed haversine-2.7.0
[1.6833250775073447, 2.4575932783467835, 5.036384146783453, 1.661685753650294, 4.107873890221249, 0.0, 9.521855346882292, 0.8032336690
```

	fare_amount	pickup_longitude	pickup_latitude	dropoff_longitude	dropoff_latitude	passenger_count	hour	day	month	year	dayof
0	7.5	-73.999817	40.738354	-73.999512	40.723217	1.0	19	7	5	2015	
1	7.7	-73.994355	40.728225	-73.994710	40.750325	1.0	20	17	7	2009	
2	12.9	-74.005043	40.740770	-73.962565	40.772647	1.0	21	24	8	2009	
3	5.3	-73.976124	40.790844	-73.965316	40.803349	3.0	8	26	6	2009	
4	16.0	-73.929896	40.744085	-73.973082	40.761247	3.5	17	28	8	2014	

```
#Uber doesn't travel over 130 kms so minimize the distance
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: (80416, 12)
```

```
#Finding inccorect latitude (Less than or greater than 90) and
#longitude (less than or greater than 180)
incorrect_coordinates = df.loc[(df.pickup_latitude > 90)  |
                               (df.pickup_latitude < -90) |
                               (df.dropoff_latitude > 180)|
                               (df.pickup_longitude >-180)|
                               (df.dropoff_longitude > 90)|
                               (df.dropoff_longitude<-90)]


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

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	fare_amount	pickup_longitude	pickup_latitude	dropoff_longitude	dropoff_latitude	passenger_count	hour	day	month	year	dayof
0	7.5	-73.999817	40.738354	-73.999512	40.723217	1.0	19	7	5	2015	
1	7.7	-73.994355	40.728225	-73.994710	40.750325	1.0	20	17	7	2009	
2	12.9	-74.005043	40.740770	-73.962565	40.772647	1.0	21	24	8	2009	
3	5.3	-73.976124	40.790844	-73.965316	40.803349	3.0	8	26	6	2009	
4	16.0	-73.929896	40.744085	-73.973082	40.761247	3.5	17	28	8	2014	

```
df.isnull().sum()
```

```
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
```

```
sns.heatmap(df.isnull()) #Free for null values
```

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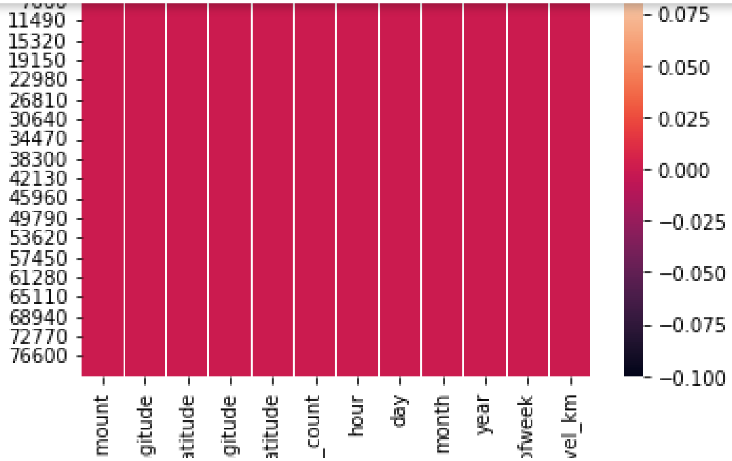

```
corr =df.corr() #Function to find the correlation
corr
```

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			atitude	dropoff_longitude	dropoff_latitude	passenger_count	hour	
fare_amount	1.000000	0.158149	0.113400	0.216307	-0.132636	0.014184	-0.016082	0.00
pickup_longitude	0.158149	1.000000	0.259929	0.427068	0.075002	-0.009711	0.008879	-0.00
pickup_latitude	-0.113400	0.259929	1.000000	0.049440	0.521595	-0.009720	0.031000	-0.00

```
fig,axis = plt.subplots(figsize = (12,8))
#Correlation Heatmap (Light values means highly correlated)
sns.heatmap(df.corr(),annot = True)
```

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Dividing the dataset into feature and target values

```
df.columns
```

```
Index(['fare_amount', 'pickup_longitude', 'pickup_latitude',
       'dropoff_longitude', 'dropoff_latitude', 'passenger_count', 'hour',
       'day', 'month', 'year', 'dayofweek', 'dist_travel_km'],
      dtype='object')
```

```
x=df[['pickup_longitude','pickup_latitude','dropoff_longitude',
      'dropoff_latitude','passenger_count','hour','day','month',
      'year','dayofweek','dist_travel_km']]
```

```
y=df[['fare_amount']]
```

Dividing the dataset into training and testing dataset

```
from sklearn.model_selection import train_test_split
X_train,X_test,y_train,y_test = train_test_split(x,y,test_size = 0.20)
```

Linear Regression

```
from sklearn.linear_model import LinearRegression
regression = LinearRegression()
```

```
regression.fit(X_train,y_train)
```

```
LinearRegression()
```

```
regression.intercept_ #To find the linear intercept
```

```
     array([3779.00560071])
```

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```
regression.coef_ #To find the linear coeeficient
```

```
     array([[ 2.57457893e+01, -6.61066060e+00,  2.10215581e+01,
             -1.93587498e+01,  5.38030754e-02,  8.88442096e-03,
              4.29939852e-03,  5.92900691e-02,  3.69521146e-01,
             -3.55853647e-02,  1.84826576e+00]])
```

```
prediction = regression.predict(X_test) #To predict the target values
```

```
print(prediction)
```

```
     [[17.50994121]
      [ 6.99860088]
      [10.84292277]
      ...
      [10.72940609]
      [ 6.54627526]
      [ 6.36345303]]
```

```
y_test
```

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27915	4.9
50169	17.0
41698	7.5

```
from sklearn.metrics import r2_score
```

```
r2_score(y_test,prediction)
```

```
     0.682803439471712
```

```
from sklearn.metrics import mean_squared_error
```

```
MSE=mean_squared_error(y_test,prediction)
```

```
MSE
```

```
     9.484117197738067
```

```
RMSE = np.sqrt(MSE)
```

```
RMSE
```

```
     3.0796293929202045
```

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```
rf =RandomForestRegressor(n_estimators=100) #Here n_estimators means number of trees
```

```
rf.fit(X_train,y_train)
```

```
/usr/local/lib/python3.7/dist-packages/ipykernel_launcher.py:1: DataConversionWarning: A column-vector y was passed when a 1d array wa
  """Entry point for launching an IPython kernel.
RandomForestRegressor()
```

```
y_pred = rf.predict(X_test)
```

```
y_pred
```

```
array([20.0525,  7.352 , 12.4283, ..., 10.2945,  6.366 ,  4.515 ])
```

Metrics evaluatin for Random Forest

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

```
R2_Random
```

```
0.7968363495400521
```

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

```
MSE_Random
```

```
6.0745547431955815
```

+ Code + Text

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```
RMSE_Random
```

```
    2.464661182230852
```

Colab paid products - Cancel contracts here

✓ 0s completed at 11:11 AM ● ✕