In [33]:
```
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# SUB:  ML
```

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

In [2]:
```
df = pd.read_csv("uber.csv")
df.head()
```

Out[2]:

| | Unnamed: 0 | key | fare_amount | pickup_datetime | pickup_longitude | pickup_latitude | dropoff_longitude | dropoff_latitude | passenger_count |
|---|---|---|---|---|---|---|---|---|---|
| 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 |
| 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 | 1 |
| 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 | 1 |
| 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 | 3 |
| 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 | 5 |

In [3]:
```
df.drop(columns=['Unnamed: 0','key'],inplace=True)
```

In [4]:
```
df.info()
```

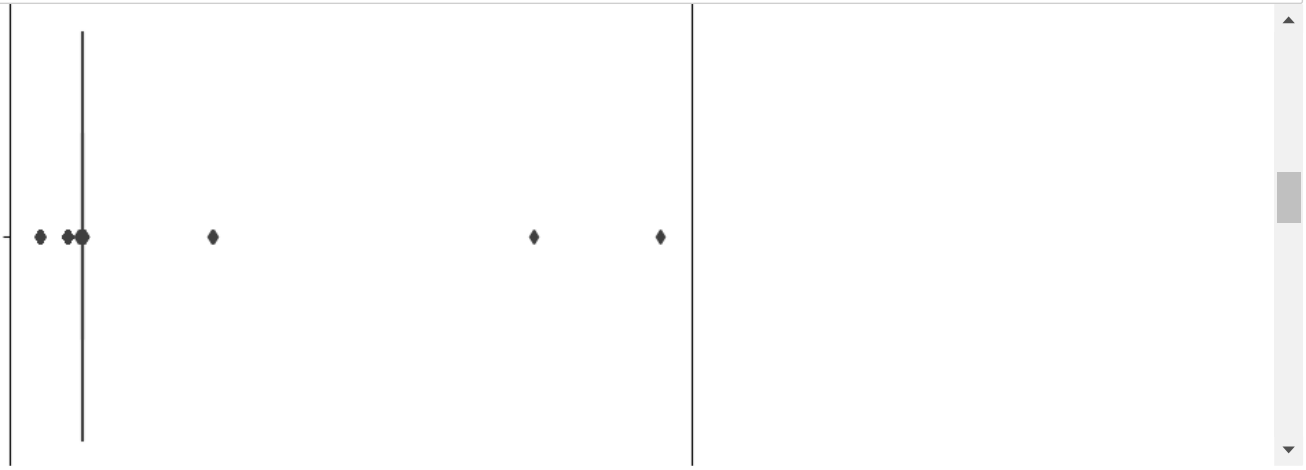
```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 200000 entries, 0 to 199999
Data columns (total 7 columns):
 #   Column             Non-Null Count   Dtype  
---  ------             --------------   -----  
 0   fare_amount        200000 non-null  float64
 1   pickup_datetime    200000 non-null  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
```

In [5]:
```
df.dropna(how='any',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]:
```
for col in df.select_dtypes(exclude=['object']):
    plt.figure()
    sns.boxplot(data=df,x=col)
```



In [8]:
```
df = df[
    (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 > -180) & (df.dropoff_longitude < 180) &
    (df.fare_amount > 0) & (df.passenger_count > 0)  & (df.passenger_count < 50)
]
```

In [9]:
```
from math import cos, asin, sqrt, pi
import numpy as np

def distance(lat_1,lon_1,lat_2,lon_2):
#     lat1 = row.pickup_latitude
#     lon1 = row.pickup_longitude
#     lat2 = row.dropoff_latitude
#     lon2 = row.dropoff_longitude
    lon_1, lon_2, lat_1, lat_2 = map(np.radians, [lon_1, lon_2, lat_1, lat_2])  #Degrees to Radians


    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(diff_lon/2.0)**2))

    return km
```

In [10]:
```
temp = distance(df['pickup_latitude'],df['pickup_longitude'],df['dropoff_latitude'],df['dropoff_longitude'])
temp.head()
```

Out[10]:
```
0    1.683323
1    2.457590
2    5.036377
3    1.661683
4    4.475450
dtype: float64
```

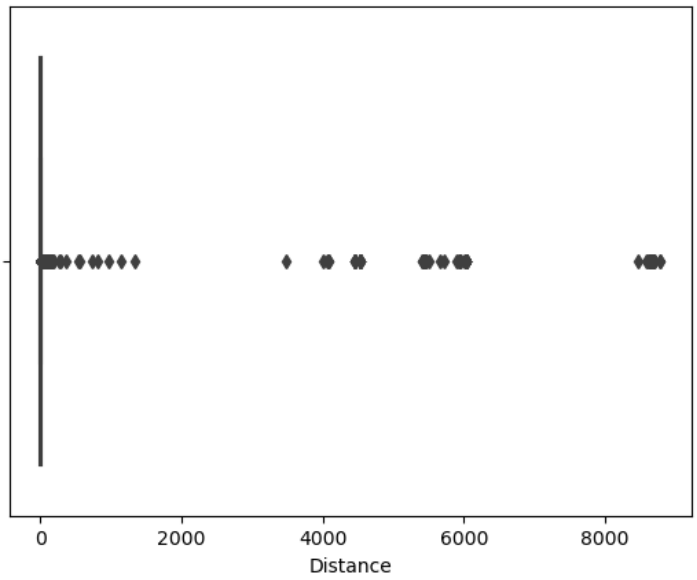
In [11]:
```
df_new = df.copy()
df_new['Distance'] = temp
df = df_new
df.head()
```

Out[11]:

| | fare_amount | pickup_datetime | pickup_longitude | pickup_latitude | dropoff_longitude | dropoff_latitude | passenger_count | Distance |
|---|---|---|---|---|---|---|---|---|
| **0** | 7.5 | 2015-05-07 19:52:06 UTC | -73.999817 | 40.738354 | -73.999512 | 40.723217 | 1 | 1.683323 |
| **1** | 7.7 | 2009-07-17 20:04:56 UTC | -73.994355 | 40.728225 | -73.994710 | 40.750325 | 1 | 2.457590 |
| **2** | 12.9 | 2009-08-24 21:45:00 UTC | -74.005043 | 40.740770 | -73.962565 | 40.772647 | 1 | 5.036377 |
| **3** | 5.3 | 2009-06-26 08:22:21 UTC | -73.976124 | 40.790844 | -73.965316 | 40.803349 | 3 | 1.661683 |
| **4** | 16.0 | 2014-08-28 17:47:00 UTC | -73.925023 | 40.744085 | -73.973082 | 40.761247 | 5 | 4.475450 |

In [12]:
```
sns.boxplot(data=df,x='Distance')
```

Out[12]: <AxesSubplot:xlabel='Distance'>




In [13]:
```
df = df[(df['Distance'] < 200) & (df['Distance'] > 0)]
```

In [14]:
```
df['pickup_datetime'] = pd.to_datetime(df['pickup_datetime'])
```

```
C:\Users\scs\AppData\Local\Temp\ipykernel_2784\1295461447.py:1: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy (https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy)
  df['pickup_datetime'] = pd.to_datetime(df['pickup_datetime'])
```

In [15]:
```
df['week_day'] = df['pickup_datetime'].dt.day_name()
df['Year'] = df['pickup_datetime'].dt.year
df['Month'] = df['pickup_datetime'].dt.month
df['Hour'] = df['pickup_datetime'].dt.hour
```

```
C:\Users\scs\AppData\Local\Temp\ipykernel_2784\2592915223.py:1: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy (https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy)
  df['week_day'] = df['pickup_datetime'].dt.day_name()
C:\Users\scs\AppData\Local\Temp\ipykernel_2784\2592915223.py:2: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy (https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy)
  df['Year'] = df['pickup_datetime'].dt.year
C:\Users\scs\AppData\Local\Temp\ipykernel_2784\2592915223.py:3: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy (https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy)
  df['Month'] = df['pickup_datetime'].dt.month
C:\Users\scs\AppData\Local\Temp\ipykernel_2784\2592915223.py:4: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy (https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy)
  df['Hour'] = df['pickup_datetime'].dt.hour
```

In [16]:
```
df.drop(columns=['pickup_datetime','pickup_latitude','pickup_longitude','dropoff_latitude','dropoff_longitude'],inplace=True
```

```
C:\Users\scs\AppData\Local\Temp\ipykernel_2784\3782303944.py:1: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy (https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy)
  df.drop(columns=['pickup_datetime','pickup_latitude','pickup_longitude','dropoff_latitude','dropoff_longitude'],inplace=True)
```

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

Out[17]:

| | fare_amount | passenger_count | Distance | week_day | Year | Month | Hour |
|---|---|---|---|---|---|---|---|
| **0** | 7.5 | 1 | 1.683323 | Thursday | 2015 | 5 | 19 |
| **1** | 7.7 | 1 | 2.457590 | Friday | 2009 | 7 | 20 |
| **2** | 12.9 | 1 | 5.036377 | Monday | 2009 | 8 | 21 |
| **3** | 5.3 | 3 | 1.661683 | Friday | 2009 | 6 | 8 |
| **4** | 16.0 | 5 | 4.475450 | Thursday | 2014 | 8 | 17 |

In [18]:
```
temp = df.copy()

def convert_week_day(day):
    if day in ['Monday','Tuesday','Wednesday','Thursday']:
        return 0 # Weekday
    return 1 # Weekend

def convert_hour(hour):
    if 5 <= hour <= 12:
        return 1
    elif 12 < hour <= 17:
        return 2
    elif 17 < hour < 24:
        return 3
    return 0

df['week_day'] = temp['week_day'].apply(convert_week_day)
df['Hour'] = temp['Hour'].apply(convert_hour)
df.head()
```

```
C:\Users\scs\AppData\Local\Temp\ipykernel_2784\619704178.py:17: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy (https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy)
  df['week_day'] = temp['week_day'].apply(convert_week_day)
C:\Users\scs\AppData\Local\Temp\ipykernel_2784\619704178.py:18: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy (https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy)
  df['Hour'] = temp['Hour'].apply(convert_hour)
```

Out[18]:

| | fare_amount | passenger_count | Distance | week_day | Year | Month | Hour |
|---|---|---|---|---|---|---|---|
| **0** | 7.5 | 1 | 1.683323 | 0 | 2015 | 5 | 3 |
| **1** | 7.7 | 1 | 2.457590 | 1 | 2009 | 7 | 3 |
| **2** | 12.9 | 1 | 5.036377 | 0 | 2009 | 8 | 3 |
| **3** | 5.3 | 3 | 1.661683 | 1 | 2009 | 6 | 1 |
| **4** | 16.0 | 5 | 4.475450 | 0 | 2014 | 8 | 2 |

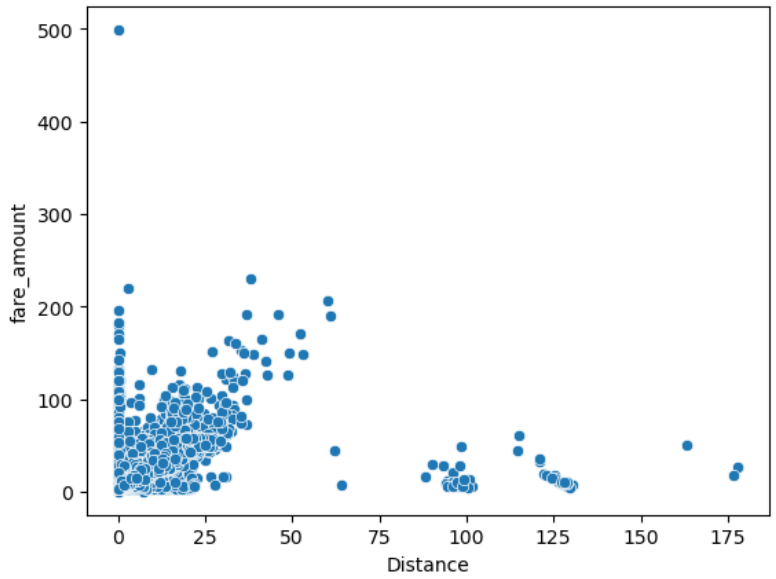
In [19]:
```
df.corr()
```

Out[19]:

| | fare_amount | passenger_count | Distance | week_day | Year | Month | Hour |
|---|---|---|---|---|---|---|---|
| **fare_amount** | 1.000000 | 0.011884 | 0.778667 | 0.002305 | 0.120430 | 0.024120 | -0.021078 |
| **passenger_count** | 0.011884 | 1.000000 | 0.005112 | 0.035882 | 0.005339 | 0.008818 | 0.013572 |
| **Distance** | 0.778667 | 0.005112 | 1.000000 | 0.014518 | 0.018617 | 0.007373 | -0.022691 |
| **week_day** | 0.002305 | 0.035882 | 0.014518 | 1.000000 | 0.006910 | -0.007328 | -0.078129 |
| **Year** | 0.120430 | 0.005339 | 0.018617 | 0.006910 | 1.000000 | -0.115182 | 0.001131 |
| **Month** | 0.024120 | 0.008818 | 0.007373 | -0.007328 | -0.115182 | 1.000000 | -0.005410 |
| **Hour** | -0.021078 | 0.013572 | -0.022691 | -0.078129 | 0.001131 | -0.005410 | 1.000000 |

In [20]:
```
sns.scatterplot(y=df['fare_amount'],x=df['Distance'])
```

Out[20]: <AxesSubplot:xlabel='Distance', ylabel='fare_amount'>




In [21]:
```
from sklearn.preprocessing import StandardScaler
x = df[['Distance']].values
y = df['fare_amount'].values.reshape(-1,1)
```

In [22]:
```
from sklearn.model_selection import train_test_split
x_train, x_test, y_train,y_test = train_test_split(x,y,random_state=10)
```

In [23]:
```
std_x = StandardScaler()
x_train = std_x.fit_transform(x_train)
```

In [24]:
```
x_test = std_x.transform(x_test)
```

In [25]:
```
std_y = StandardScaler()
y_train = std_y.fit_transform(y_train)
```

In [26]:
```
y_test = std_y.transform(y_test)
```

In [27]:
```
from sklearn.metrics import mean_squared_error,r2_score, mean_absolute_error
def fit_predict(model):
    model.fit(x_train,y_train.ravel())
    y_pred = model.predict(x_test)
    r_squared = r2_score(y_test,y_pred)
    RMSE = mean_squared_error(y_test, y_pred,squared=False)
    MAE = mean_absolute_error(y_test,y_pred)
    print('R-squared: ', r_squared)
    print('RMSE: ', RMSE)
    print("MAE:  ",MAE)
```

In [28]:
```
from sklearn.linear_model import LinearRegression
```

In [31]:
```
fit_predict(LinearRegression())
```

```
R-squared:  0.6041167920841168
RMSE:  0.6290054895695946
MAE:  0.2755232959095983
```

In [32]:
```
from sklearn.ensemble import RandomForestRegressor
fit_predict(RandomForestRegressor())
```

```
R-squared:  0.6517292843086854
RMSE:  0.589969247698516
MAE:  0.29191122033887024
```