In [138…

```
# Predict the price of the Uber ride from a given pickup point to the agreed drop-o
# location. Perform following tasks:
# 1. Pre-process the dataset.
# 2. Identify outliers.
# 3. Check the correlation.
# 4. Implement linear regression and ridge, Lasso regression models.
# 5. Evaluate the models and compare their respective scores like R2, RMSE, etc.
```

In [139…

```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
from sklearn.model_selection import train_test_split
from sklearn.linear_model import LinearRegression, Ridge, Lasso
from sklearn.metrics import mean_squared_error, r2_score
from math import radians, cos, sin, asin, sqrt
```

In [140…

```
uber = pd.read_csv('uber.csv')
uber.head()
```

Out[140…

| | Unnamed: 0 | key | fare_amount | pickup_datetime | pickup_longitude | pickup_ |
|---|---|---|---|---|---|---|
| **0** | 24238194 | 2015-05-07 19:52:06.0000003 | 7.5 | 2015-05-07 19:52:06 UTC | -73.999817 | 4( |
| **1** | 27835199 | 2009-07-17 20:04:56.0000002 | 7.7 | 2009-07-17 20:04:56 UTC | -73.994355 | 4( |
| **2** | 44984355 | 2009-08-24 21:45:00.00000061 | 12.9 | 2009-08-24 21:45:00 UTC | -74.005043 | 4( |
| **3** | 25894730 | 2009-06-26 08:22:21.0000001 | 5.3 | 2009-06-26 08:22:21 UTC | -73.976124 | 4( |
| **4** | 17610152 | 2014-08-28 17:47:00.000000188 | 16.0 | 2014-08-28 17:47:00 UTC | -73.925023 | 4( |

In [141…

```
print("Number of columns: ", uber.shape[1])
print("Number of rows: ", uber.shape[0])
```

```
Number of columns:  9
Number of rows:  200000
```

In [142…

```
uber.columns
```

Out[142…

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

In [143…

```
uber.info()
```

```
<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
```

In [144…

```
print("Missing values: ", uber.isnull().sum())
```

```
Missing values:  Unnamed: 0           0
key                  0
fare_amount          0
pickup_datetime      0
pickup_longitude     0
pickup_latitude      0
dropoff_longitude    1
dropoff_latitude     1
passenger_count      0
dtype: int64
```

In [145…

```
uber = uber.drop(['Unnamed: 0', 'key'], axis=1)
uber.head()
```

Out[145…

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

In [146…

```
uber['pickup_datetime'] = pd.to_datetime(uber['pickup_datetime'], errors='coerce')
```

In [147…

```
uber = uber.dropna(subset=['pickup_datetime'])
```

In [148…
```
uber = uber.dropna(subset=['dropoff_longitude', 'dropoff_latitude'])
```

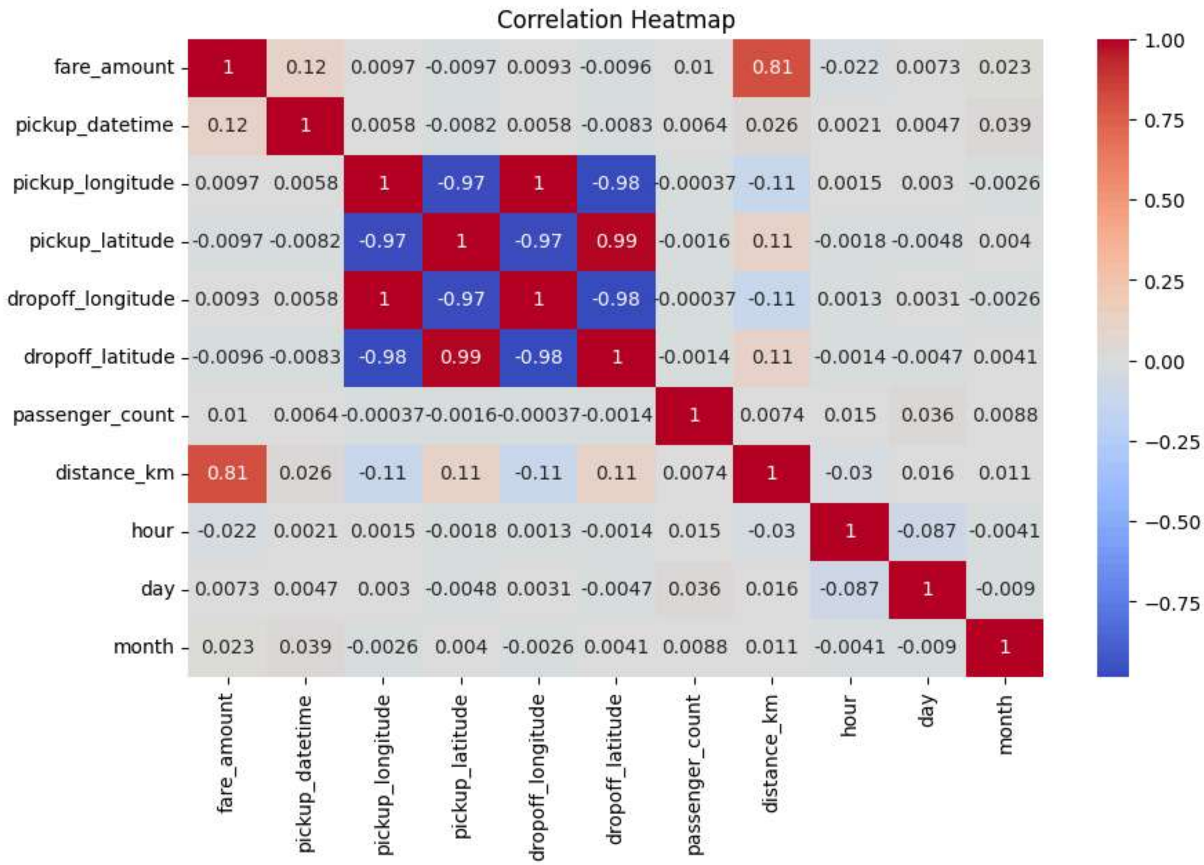
In [149…
```
# Data Engineering
def haversine(lon1, lat1, lon2, lat2):
    lon1, lat1, lon2, lat2 = map(radians, [lon1, lat1, lon2, lat2])
    dlon = lon2 - lon1
    dlat = lat2 - lat1
    a = sin(dlat/2)**2 + cos(lat1)*cos(lat2)*sin(dlon/2)**2
    c = 2 * asin(sqrt(a))
    km = 6371 * c
    return km
```

In [150…
```
uber['distance_km'] = uber.apply(lambda row: haversine(
    row['pickup_longitude'], row['pickup_latitude'],
    row['dropoff_longitude'], row['dropoff_latitude']), axis=1)
```

In [151…
```
uber['hour'] = uber['pickup_datetime'].dt.hour
uber['day'] = uber['pickup_datetime'].dt.dayofweek   # Monday=0, Sunday=6
uber['month'] = uber['pickup_datetime'].dt.month
```

In [152…
```
#Outliers
uber = uber[(uber['fare_amount'] > 0) & (uber['fare_amount'] < 500)]
uber = uber[(uber['passenger_count'] > 0) & (uber['passenger_count'] <= 6)]
uber = uber[(uber['distance_km'] < 100)]
```

In [153…
```
plt.figure(figsize=(10,6))
sns.heatmap(uber.corr(), annot=True, cmap='coolwarm')
plt.title("Correlation Heatmap")
plt.show()
```




In [154…

```
# Prepare Data
X = uber[['pickup_longitude', 'pickup_latitude', 'dropoff_longitude',
          'dropoff_latitude', 'passenger_count', 'distance_km',
          'hour', 'day', 'month']]
y = uber['fare_amount']
```

In [155…

```
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_sta
```

In [156…

```
#Train models
lr = LinearRegression()
ridge = Ridge(alpha=1.0)
lasso = Lasso(alpha=0.1)

lr.fit(X_train, y_train)
ridge.fit(X_train, y_train)
lasso.fit(X_train, y_train)
```

Out[156…

```
▾ Lasso
Lasso(alpha=0.1)
```

In [157…

```
#Predictions
y_pred_lr = lr.predict(X_test)
y_pred_ridge = ridge.predict(X_test)
y_pred_lasso = lasso.predict(X_test)
```

In [158…

```
# Evaluate models
def evaluate_model(y_true, y_pred, model_name):
    rmse = np.sqrt(mean_squared_error(y_true, y_pred))
    r2 = r2_score(y_true, y_pred)
    print(f"{model_name} --> RMSE: {rmse:.2f}, R2: {r2:.3f}")
```

In [159…

```
evaluate_model(y_test, y_pred_lr, "Linear Regression")
evaluate_model(y_test, y_pred_ridge, "Ridge Regression")
evaluate_model(y_test, y_pred_lasso, "Lasso Regression")
```

```
Linear Regression --> RMSE: 5.48, R2: 0.695
Ridge Regression --> RMSE: 5.48, R2: 0.695
Lasso Regression --> RMSE: 5.51, R2: 0.691
```