In [2]:
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
from sklearn.model_selection import train_test_split
from sklearn.preprocessing import StandardScaler
from sklearn.linear_model import LinearRegression
from sklearn.linear_model import LinearRegression, Ridge, Lasso
from sklearn.model_selection import GridSearchCV
from sklearn.metrics import r2_score, mean_squared_error


import warnings
warnings.filterwarnings('ignore')
```

In [3]:
```
# Load the dataset

path = r"C:\Users\Downloads\archive (11)\uber.csv"
df = pd.read_csv(path)

# view dataset
df
```

Out[3]:

	Unnamed: 0	key	fare_amount	pickup_datetime	pickup_longitude	pickup_latitude	dropoff_longitude	dropoff
0	24238194	2015-05-07 19:52:06.0000003	7.5	2015-05-07 19:52:06 UTC	-73.999817	40.738354	-73.999512	4
1	27835199	2009-07-17 20:04:56.0000002	7.7	2009-07-17 20:04:56 UTC	-73.994355	40.728225	-73.994710	4
2	44984355	2009-08-24 21:45:00.00000061	12.9	2009-08-24 21:45:00 UTC	-74.005043	40.740770	-73.962565	4
3	25894730	2009-06-26 08:22:21.0000001	5.3	2009-06-26 08:22:21 UTC	-73.976124	40.790844	-73.965316	4
4	17610152	2014-08-28 17:47:00.000000188	16.0	2014-08-28 17:47:00 UTC	-73.925023	40.744085	-73.973082	4
...	...	...	...	...	...	...	...	...
199995	42598914	2012-10-28 10:49:00.00000053	3.0	2012-10-28 10:49:00 UTC	-73.987042	40.739367	-73.986525	4
199996	16382965	2014-03-14 01:09:00.0000008	7.5	2014-03-14 01:09:00 UTC	-73.984722	40.736837	-74.006672	4
199997	27804658	2009-06-29 00:42:00.00000078	30.9	2009-06-29 00:42:00 UTC	-73.986017	40.756487	-73.858957	4
199998	20259894	2015-05-20 14:56:25.0000004	14.5	2015-05-20 14:56:25 UTC	-73.997124	40.725452	-73.983215	4
199999	11951496	2010-05-15 04:08:00.00000076	14.1	2010-05-15 04:08:00 UTC	-73.984395	40.720077	-73.985508	4

200000 rows × 9 columns

In [4]:
```
df.columns
```

Out[4]:
```
Index(['Unnamed: 0', 'key', 'fare_amount', 'pickup_datetime',
       'pickup_longitude', 'pickup_latitude', 'dropoff_longitude',
       'dropoff_latitude', 'passenger_count'],
      dtype='object')
```

In [5]:
```
df.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 [6]:
```
df.isnull().sum()
```

Out[6]:
```
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 [7]:
```
df = df.dropna()
```

In [8]:
```
df.isnull().sum()
```

Out[8]:
```
Unnamed: 0           0
key                  0
fare_amount          0
pickup_datetime      0
pickup_longitude     0
pickup_latitude      0
dropoff_longitude    0
dropoff_latitude     0
passenger_count      0
dtype: int64
```

In [9]:
```
df['pickup_datetime'] = pd.to_datetime(df['pickup_datetime'])
# print(df['pickup_datetime'])
df['hour'] = df['pickup_datetime'].dt.hour
# print(df['hour'])
df['day_of_week'] = df['pickup_datetime'].dt.dayofweek
# print(df['day_of_week'])
```

In [10]:
```
# check datasets for more columns we added 'hour' and 'day_of_week' column
df
```

Out[10]:

	Unnamed: 0	key	fare_amount	pickup_datetime	pickup_longitude	pickup_latitude	dropoff_longitude	dropoff
0	24238194	2015-05-07 19:52:06.0000003	7.5	2015-05-07 19:52:06+00:00	-73.999817	40.738354	-73.999512	4
1	27835199	2009-07-17 20:04:56.0000002	7.7	2009-07-17 20:04:56+00:00	-73.994355	40.728225	-73.994710	4
2	44984355	2009-08-24 21:45:00.00000061	12.9	2009-08-24 21:45:00+00:00	-74.005043	40.740770	-73.962565	4
3	25894730	2009-06-26 08:22:21.0000001	5.3	2009-06-26 08:22:21+00:00	-73.976124	40.790844	-73.965316	4
4	17610152	2014-08-28 17:47:00.000000188	16.0	2014-08-28 17:47:00+00:00	-73.925023	40.744085	-73.973082	4
...	...	...	...	...	...	...	...	
199995	42598914	2012-10-28 10:49:00.00000053	3.0	2012-10-28 10:49:00+00:00	-73.987042	40.739367	-73.986525	4
199996	16382965	2014-03-14 01:09:00.0000008	7.5	2014-03-14 01:09:00+00:00	-73.984722	40.736837	-74.006672	4
199997	27804658	2009-06-29 00:42:00.00000078	30.9	2009-06-29 00:42:00+00:00	-73.986017	40.756487	-73.858957	4
199998	20259894	2015-05-20 14:56:25.0000004	14.5	2015-05-20 14:56:25+00:00	-73.997124	40.725452	-73.983215	4
199999	11951496	2010-05-15 04:08:00.00000076	14.1	2010-05-15 04:08:00+00:00	-73.984395	40.720077	-73.985508	4

199999 rows × 11 columns

In [11]:
```
# Drop unnecessary columns
df = df.drop(columns=['Unnamed: 0', 'key', 'pickup_datetime'])
```

In [12]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Index: 199999 entries, 0 to 199999
Data columns (total 8 columns):
 #   Column             Non-Null Count   Dtype  
---  ------             --------------   -----  
 0   fare_amount        199999 non-null  float64
 1   pickup_longitude   199999 non-null  float64
 2   pickup_latitude    199999 non-null  float64
 3   dropoff_longitude  199999 non-null  float64
 4   dropoff_latitude   199999 non-null  float64
 5   passenger_count    199999 non-null  int64  
 6   hour               199999 non-null  int32  
 7   day_of_week        199999 non-null  int32  
dtypes: float64(5), int32(2), int64(1)
memory usage: 12.2 MB
```

In [13]:
```
# check datasets for removal of columns we removed 'first_column with no name', 'key' and 'pickup_datetime' colu
df
```

Out[13]:

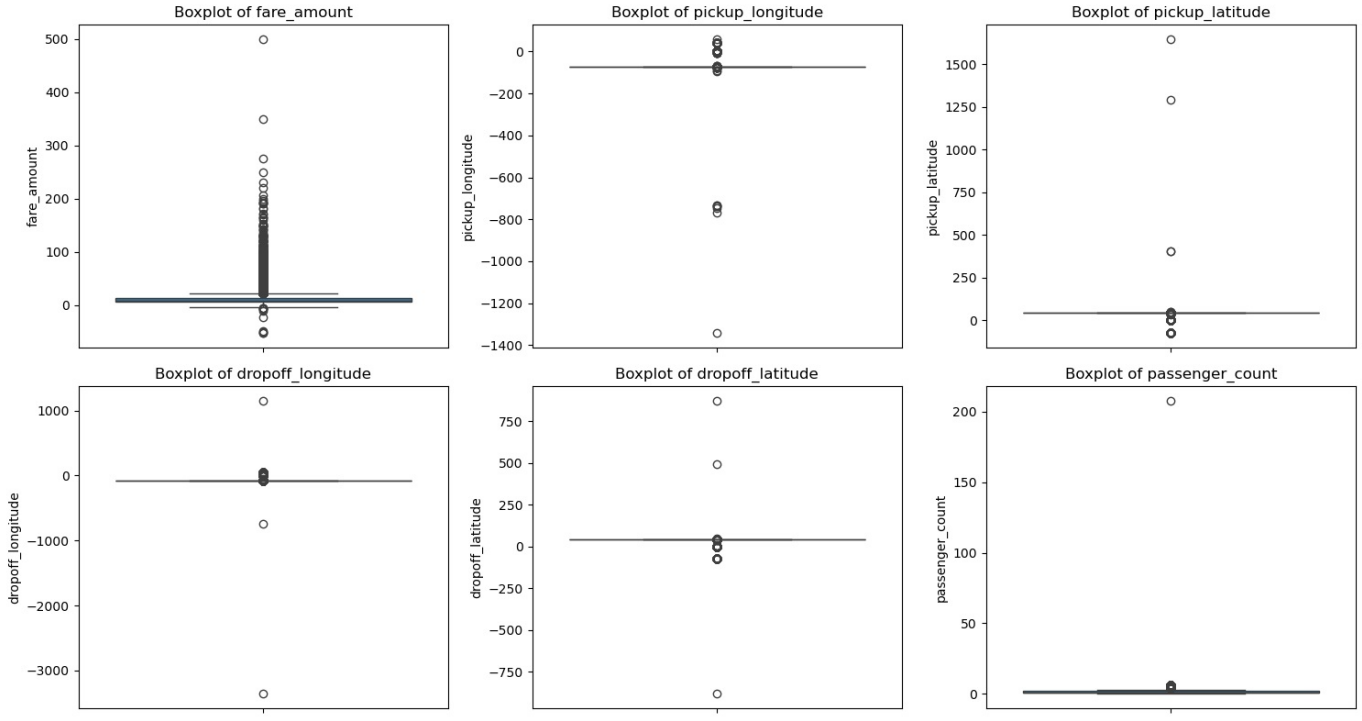
	fare_amount	pickup_longitude	pickup_latitude	dropoff_longitude	dropoff_latitude	passenger_count	hour	day_of_week
0	7.5	-73.999817	40.738354	-73.999512	40.723217	1	19	3
1	7.7	-73.994355	40.728225	-73.994710	40.750325	1	20	4
2	12.9	-74.005043	40.740770	-73.962565	40.772647	1	21	0
3	5.3	-73.976124	40.790844	-73.965316	40.803349	3	8	4
4	16.0	-73.925023	40.744085	-73.973082	40.761247	5	17	3
...	...	...	...	...	...	...	...	...
199995	3.0	-73.987042	40.739367	-73.986525	40.740297	1	10	6
199996	7.5	-73.984722	40.736837	-74.006672	40.739620	1	1	4
199997	30.9	-73.986017	40.756487	-73.858957	40.692588	2	0	0
199998	14.5	-73.997124	40.725452	-73.983215	40.695415	1	14	2
199999	14.1	-73.984395	40.720077	-73.985508	40.768793	1	4	5

199999 rows × 8 columns

In [14]:
```
import matplotlib.pyplot as plt
import seaborn as sns

numeric_cols = ['fare_amount', 'pickup_longitude', 'pickup_latitude',
                'dropoff_longitude', 'dropoff_latitude', 'passenger_count']

plt.figure(figsize=(15, 8))
for i, col in enumerate(numeric_cols, 1):
    plt.subplot(2, 3, i)
    sns.boxplot(y=df[col])
    plt.title(f'Boxplot of {col}')
plt.tight_layout()
plt.show()
```



In [15]:
```
# Split the data into features (X) and target (y)
X = df.drop(columns=['fare_amount'])  # create new dataset ignoring 'fare_amount' column
y = df['fare_amount']  # create a series of only 'fare_amount' column
```

In [16]:
```
# Split the data into training and testing sets
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_state=42)
```

In [17]:
```
# Standardize the features (scaling)
scaler = StandardScaler()
X_train_scaled = scaler.fit_transform(X_train)
X_test_scaled = scaler.transform(X_test)
```

In [18]:
```
# Implement Linear Regression
lr_model = LinearRegression()
lr_model.fit(X_train_scaled, y_train)
y_pred_lr = lr_model.predict(X_test_scaled)
```

In [30]:
```
# Ridge Regression
ridge = Ridge()
ridge_params = {'alpha': [0.01, 0.1, 1, 10, 100]}
ridge_grid = GridSearchCV(ridge, ridge_params, cv=5, scoring='r2')
ridge_grid.fit(X_train_scaled, y_train)
ridge_best = ridge_grid.best_estimator_
y_pred_ridge = ridge_best.predict(X_test_scaled)

# Lasso Regression
lasso = Lasso()
lasso_params = {'alpha': [0.01, 0.1, 1, 10, 100]}
lasso_grid = GridSearchCV(lasso, lasso_params, cv=5, scoring='r2')
lasso_grid.fit(X_train_scaled, y_train)
lasso_best = lasso_grid.best_estimator_
y_pred_lasso = lasso_best.predict(X_test_scaled)
```

In [38]:
```
from sklearn.metrics import mean_absolute_error, mean_squared_error, r2_score


def evaluate_model(name, y_true, y_pred):
    r2 = r2_score(y_true, y_pred)
    rmse = np.sqrt(mean_squared_error(y_true, y_pred))
    mae = mean_absolute_error(y_true, y_pred)

    return {
        'Model': name,
        'R2 Score': r2,
        'RMSE': rmse,
        'MAE': mae
    }
```

In [40]:
```
# Evaluate all models
results = []
results.append(evaluate_model('Linear Regression', y_test, y_pred_lr))
results.append(evaluate_model('Ridge Regression', y_test, y_pred_ridge))
results.append(evaluate_model('Lasso Regression', y_test, y_pred_lasso))

results_df = pd.DataFrame(results)
print("\nModel Evaluation Results:")
print(results_df)
```

```
Model Evaluation Results:
              Model  R2 Score       RMSE       MAE
0  Linear Regression  0.000914  10.194550  6.064055
1   Ridge Regression  0.000914  10.194551  6.064055
2   Lasso Regression  0.000870  10.194776  6.064411
```

In [ ]: