Title:Uber & Lyft Cab prices Analysis

```
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        Section: S1-04
```

The cab_rides dataset contains 2,093 records and 10 columns representing cab ride information. It includes ride distance, cab type, source and destination locations, price, surge multiplier, ride ID, product ID, and cab name. The numeric columns (distance, price, surge_multiplier, time_stamp) allow analysis of ride trends and relationships, such as how distance affects price or how surge pricing varies. Categorical columns (cab_type, source, destination, product_id, name) help in grouping rides to find the most popular routes, cab types, or destinations. Some observations: Price has missing values (1920 non-null), which may need handling before analysis. Distance ranges across different rides, useful for fare vs. distance analysis. Surge multiplier shows how peak demand affects pricing. The dataset can be used to explore ride patterns, fare distributions, peak demand effects, and the most popular cab types and locations. This dataset is suitable for data visualization, correlation analysis, and pattern discovery in cab rides.

```
In [1]: sc
```

Out[1]: **SparkContext**

Spark UI

Version	`v3.5.6`
Master	`local[*]`
AppName	`PySparkShell`

```
In [5]: from pyspark.sql import SparkSession
        from pyspark.sql.functions import col, corr
        import matplotlib.pyplot as plt
        import seaborn as sns
        import pandas as pd

        # Initialize Spark
        spark = SparkSession.builder.appName("CabRidesAnalysis").getOrCreate()
```

```
In [6]: df = spark.read.csv("cab_rides.csv", header=True, inferSchema=True)
        df.show(5)   # Preview first 5 rows
        df.printSchema()  # Check schema
```

```
+--------+--------+----------+------------+----------------+-----+----------------+--------------------+------------
+------------+
|distance|cab_type|time_stamp|  destination|          source|price|surge_multiplier|                  id|  product_id
|        name|
+--------+--------+----------+------------+----------------+-----+----------------+--------------------+------------
+------------+
|    0.44|    Lyft|1.54495E12|North Station|Haymarket Square|  5.0|             1.0|424553bb-7174-41e...|   lyft_line
|      Shared|
|    0.44|    Lyft|1.54328E12|North Station|Haymarket Square| 11.0|             1.0|4bd23055-6827-41c...|lyft_premier
|         Lux|
|    0.44|    Lyft|1.54337E12|North Station|Haymarket Square|  7.0|             1.0|981a3613-77af-462...|        lyft
|        Lyft|
|    0.44|    Lyft|1.54355E12|North Station|Haymarket Square| 26.0|             1.0|c2d88af2-d278-4bf...| lyft_luxsuv
|Lux Black XL|
|    0.44|    Lyft|1.54346E12|North Station|Haymarket Square|  9.0|             1.0|e0126e1f-8ca9-4f2...|   lyft_plus
|     Lyft XL|
+--------+--------+----------+------------+----------------+-----+----------------+--------------------+------------
+------------+
only showing top 5 rows

root
 |-- distance: double (nullable = true)
 |-- cab_type: string (nullable = true)
 |-- time_stamp: double (nullable = true)
 |-- destination: string (nullable = true)
 |-- source: string (nullable = true)
 |-- price: double (nullable = true)
 |-- surge_multiplier: double (nullable = true)
 |-- id: string (nullable = true)
 |-- product_id: string (nullable = true)
 |-- name: string (nullable = true)
```

In [7]:
```
# Summary statistics
df.describe().show()
```

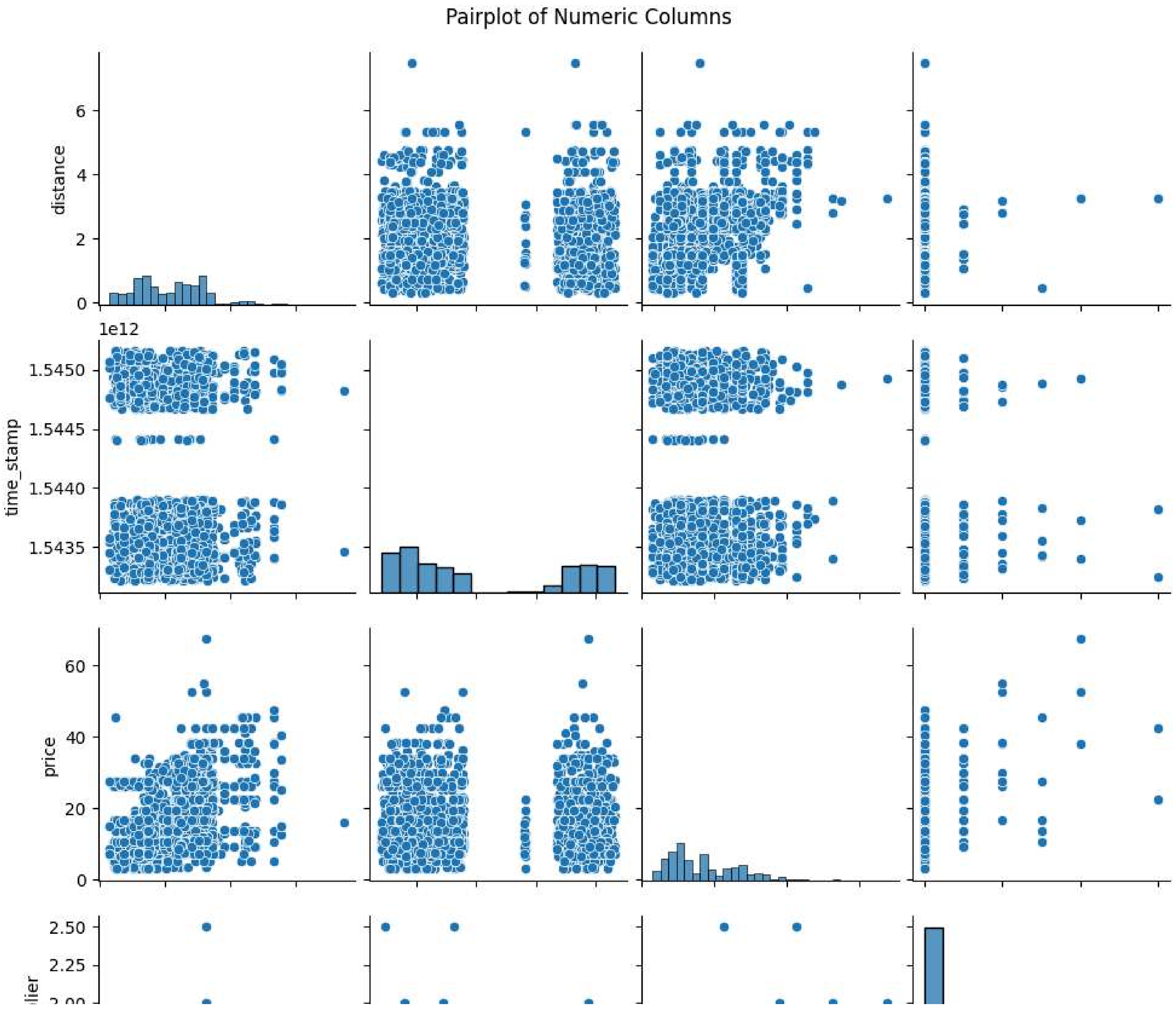
```
+-------+------------------+--------+--------------------+-----------+--------+------------------+-------------------
+--------------------+--------------------+-----+
|summary|          distance|cab_type|          time_stamp|destination|  source|             price|   surge_multiplier
|                  id|          product_id| name|
+-------+------------------+--------+--------------------+-----------+--------+------------------+-------------------
+--------------------+--------------------+-----+
|  count|              2093|    2093|                2093|       2093|    2093|              1920|               2093
|                2093|                2093| 2093|
|   mean|2.1312326803631096|    NULL|1.544018408982322E12|       NULL|    NULL|16.398177083333334|  1.010630673674152
|                NULL|                NULL| NULL|
| stddev|1.0509020571359042|    NULL|  6.86041100059527E8|       NULL|    NULL| 9.083548960021902|0.08311274424308637
|                NULL|                NULL| NULL|
|    min|               0.3|    Lyft|          1.54321E12|   Back Bay|Back Bay|               3.0|                1.0
|001e4903-c2ec-475...|55c66225-fbe7-4fd...|Black|
|    max|              7.46|    Uber|          1.54516E12|   West End|West End|              67.5|                2.5
|ffe072dd-eb41-496...|        lyft_premier|  WAV|
+-------+------------------+--------+--------------------+-----------+--------+------------------+-------------------
+--------------------+--------------------+-----+
```

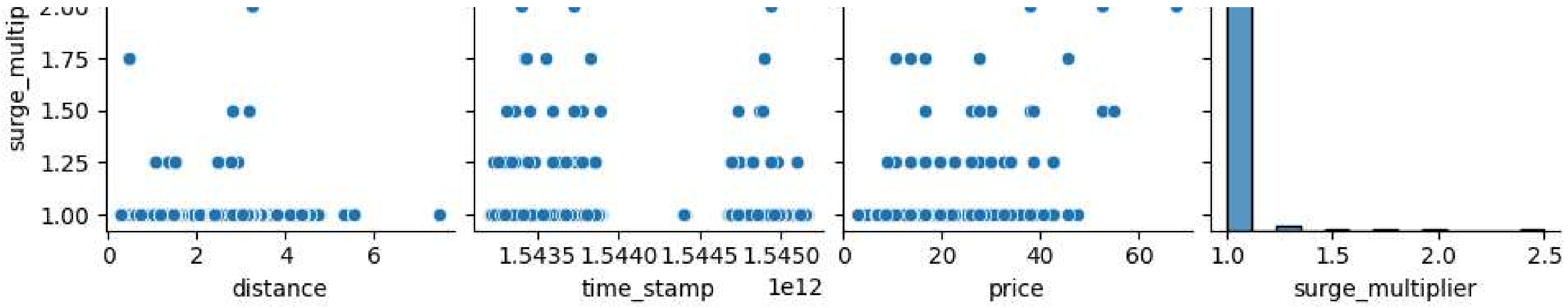
In [8]:
```python
numeric_cols = ['distance', 'time_stamp', 'price', 'surge_multiplier']

# Print correlations
for col1 in numeric_cols:
    for col2 in numeric_cols:
        if col1 != col2:
            corr_value = df.stat.corr(col1, col2)
            print(f"Correlation between {col1} and {col2}: {corr_value:.2f}")
```

```
Correlation between distance and time_stamp: 0.02
Correlation between distance and price: 0.28
Correlation between distance and surge_multiplier: 0.02
Correlation between time_stamp and distance: 0.02
Correlation between time_stamp and price: -0.00
Correlation between time_stamp and surge_multiplier: -0.02
Correlation between price and distance: 0.28
Correlation between price and time_stamp: -0.00
Correlation between price and surge_multiplier: 0.20
Correlation between surge_multiplier and distance: 0.02
Correlation between surge_multiplier and time_stamp: -0.02
Correlation between surge_multiplier and price: 0.20
```

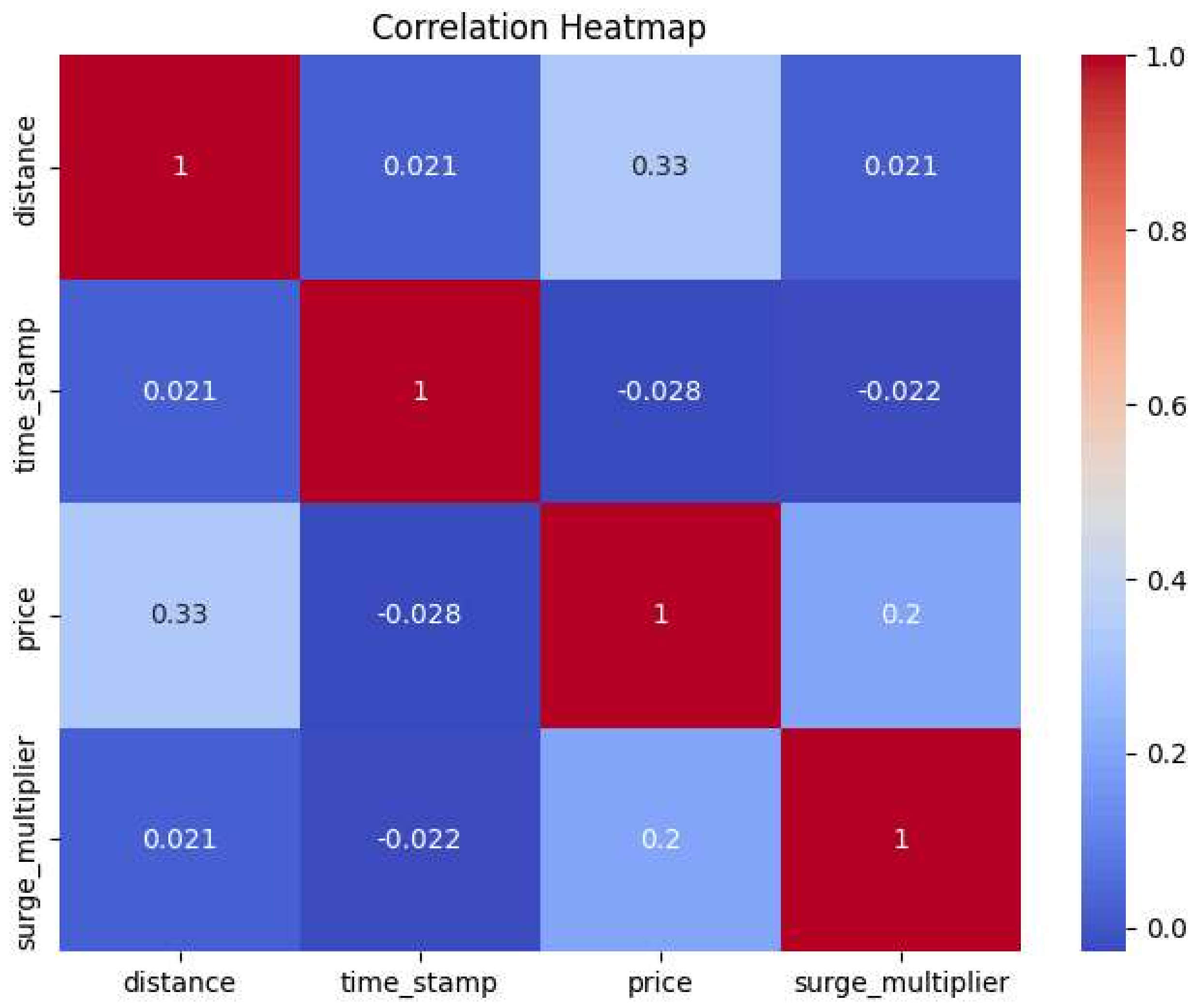
In [9]:
```python
# Convert PySpark DataFrame to Pandas
pdf = df.toPandas()
```

In [10]:
```python
sns.pairplot(pdf[numeric_cols])
plt.suptitle("Pairplot of Numeric Columns", y=1.02)
plt.show()
```

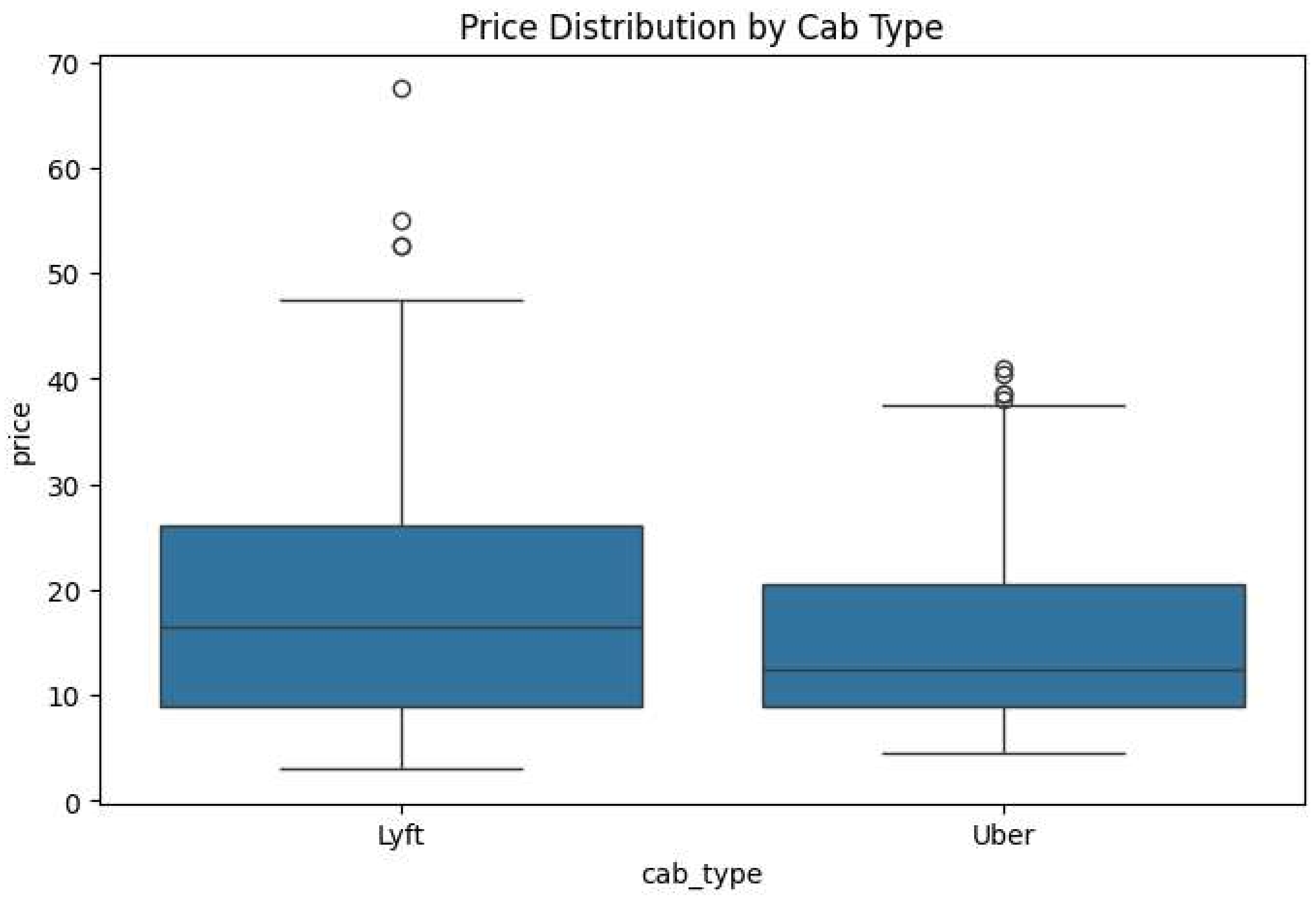

Pairplot of Numeric Columns
distance
time_stamp
price
lier
1e12
0
2
4
6
1.5435
1.5440
1.5445
1.5450
0
20
40
60
2.00
2.25
2.50



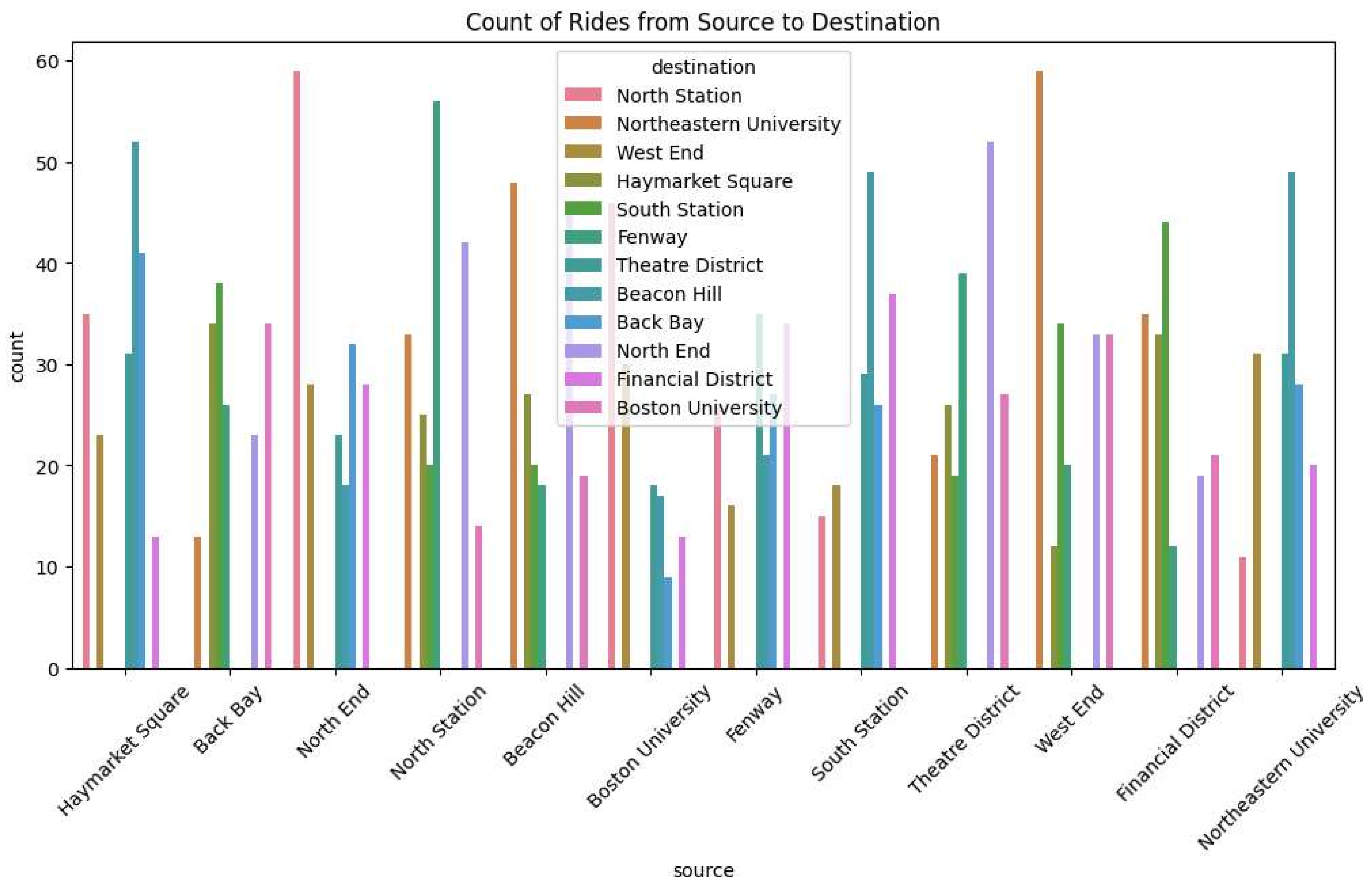
In [11]:
```
corr_matrix = pdf[numeric_cols].corr()
plt.figure(figsize=(8,6))
sns.heatmap(corr_matrix, annot=True, cmap="coolwarm")
plt.title("Correlation Heatmap")
plt.show()
```



In [12]:
```
plt.figure(figsize=(8,5))
sns.boxplot(x='cab_type', y='price', data=pdf)
plt.title("Price Distribution by Cab Type")
plt.show()
```



```
In [13]: plt.figure(figsize=(12,6))
         sns.countplot(x='source', hue='destination', data=pdf)
         plt.xticks(rotation=45)
         plt.title("Count of Rides from Source to Destination")
         plt.show()
```



In [14]:
```
# Average price by cab type
avg_price = pdf.groupby('cab_type')['price'].mean()
print("Average Price by Cab Type:")
print(avg_price)

# Most popular source
popular_source = pdf['source'].value_counts().idxmax()
print(f"Most popular source location: {popular_source}")
```

```
Average Price by Cab Type:
cab_type
Lyft     17.322598
Uber     15.554781
Name: price, dtype: float64
Most popular source location: Haymarket Square
```

In [16]:
```python
from pyspark.sql import SparkSession
from pyspark.sql.functions import col, avg, max, min, count
import matplotlib.pyplot as plt
import seaborn as sns
import pandas as pd

spark = SparkSession.builder.appName("CabRidesAnalysis2").getOrCreate()
```

In [17]:
```python
df = spark.read.csv("cab_rides.csv", header=True, inferSchema=True)
df.show(5)
df.printSchema()
```

```
+--------+--------+----------+------------+----------------+-----+----------------+--------------------+------------
+------------+
|distance|cab_type|time_stamp|  destination|          source|price|surge_multiplier|                  id|  product_id
|        name|
+--------+--------+----------+------------+----------------+-----+----------------+--------------------+------------
+------------+
|    0.44|    Lyft|1.54495E12|North Station|Haymarket Square|  5.0|             1.0|424553bb-7174-41e...|   lyft_line
|      Shared|
|    0.44|    Lyft|1.54328E12|North Station|Haymarket Square| 11.0|             1.0|4bd23055-6827-41c...|lyft_premier
|         Lux|
|    0.44|    Lyft|1.54337E12|North Station|Haymarket Square|  7.0|             1.0|981a3613-77af-462...|        lyft
|        Lyft|
|    0.44|    Lyft|1.54355E12|North Station|Haymarket Square| 26.0|             1.0|c2d88af2-d278-4bf...| lyft_luxsuv
|Lux Black XL|
|    0.44|    Lyft|1.54346E12|North Station|Haymarket Square|  9.0|             1.0|e0126e1f-8ca9-4f2...|   lyft_plus
|     Lyft XL|
+--------+--------+----------+------------+----------------+-----+----------------+--------------------+------------
+------------+
only showing top 5 rows

root
 |-- distance: double (nullable = true)
 |-- cab_type: string (nullable = true)
 |-- time_stamp: double (nullable = true)
 |-- destination: string (nullable = true)
 |-- source: string (nullable = true)
 |-- price: double (nullable = true)
 |-- surge_multiplier: double (nullable = true)
 |-- id: string (nullable = true)
 |-- product_id: string (nullable = true)
 |-- name: string (nullable = true)
```

In [18]:
```
avg_price_cab = df.groupBy("cab_type").agg(avg("price").alias("avg_price"))
avg_price_cab.show()
```

```
+--------+------------------+
|cab_type|         avg_price|
+--------+------------------+
|    Lyft| 17.32259825327511|
|    Uber|15.554780876494023|
+--------+------------------+
```

```
In [19]: max_distance_cab = df.groupBy("cab_type").agg(max("distance").alias("max_distance"))
         max_distance_cab.show()
```

```
+--------+------------+
|cab_type|max_distance|
+--------+------------+
|    Lyft|        5.33|
|    Uber|        7.46|
+--------+------------+
```

```
In [20]: rides_per_source = df.groupBy("source").agg(count("*").alias("num_rides"))
         rides_per_source.show()
```

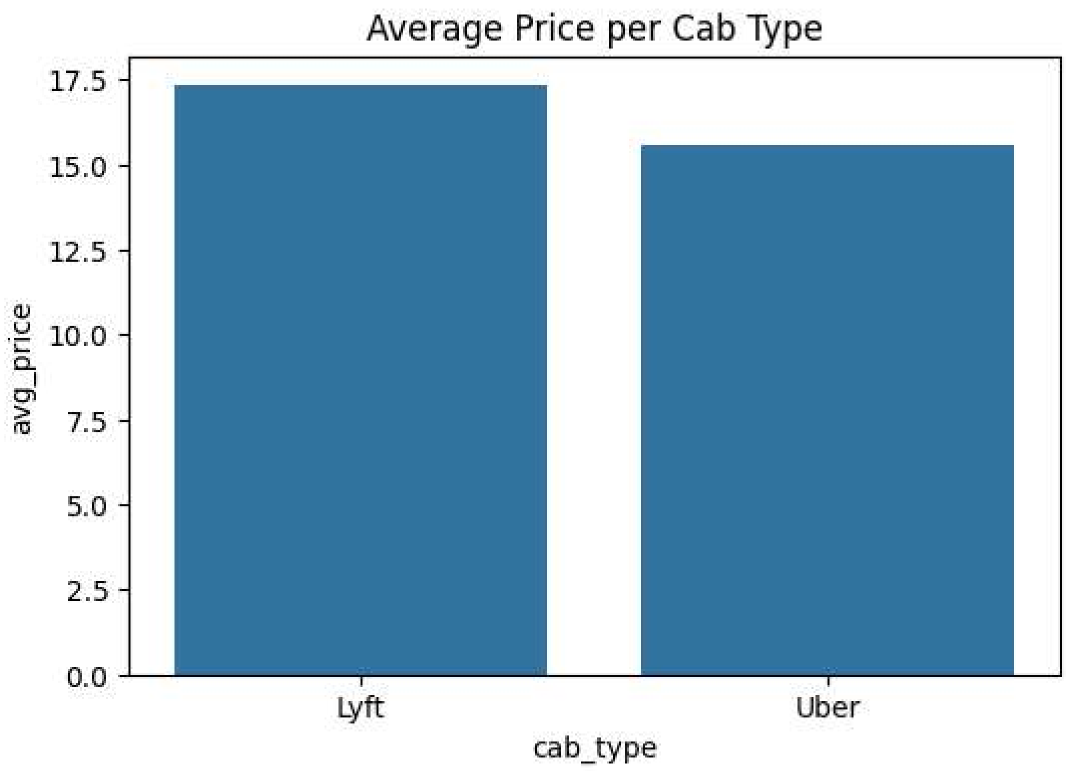
```
+--------------------+---------+
|              source|num_rides|
+--------------------+---------+
|  Financial District|      164|
|Northeastern Univ...|      170|
|           North End|      188|
|   Boston University|      133|
|       North Station|      190|
|            Back Bay|      168|
|    Theatre District|      184|
|       South Station|      174|
|              Fenway|      159|
|    Haymarket Square|      195|
|            West End|      191|
|         Beacon Hill|      177|
+--------------------+---------+
```

```
In [21]: avg_surge_destination = df.groupBy("destination").agg(avg("surge_multiplier").alias("avg_surge"))
         avg_surge_destination.show()
```

```
+--------------------+------------------+
|         destination|         avg_surge|
+--------------------+------------------+
|  Financial District|               1.0|
|Northeastern Univ...|               1.0|
|           North End|               1.0|
|   Boston University| 1.008445945945946|
|       North Station|               1.0|
|            Back Bay|1.0368098159509203|
|    Theatre District|1.0224550898203593|
|       South Station|1.0214285714285714|
|              Fenway|1.0146198830409356|
|    Haymarket Square|1.0079617834394905|
|            West End|1.0256849315068493|
|         Beacon Hill|               1.0|
+--------------------+------------------+
```

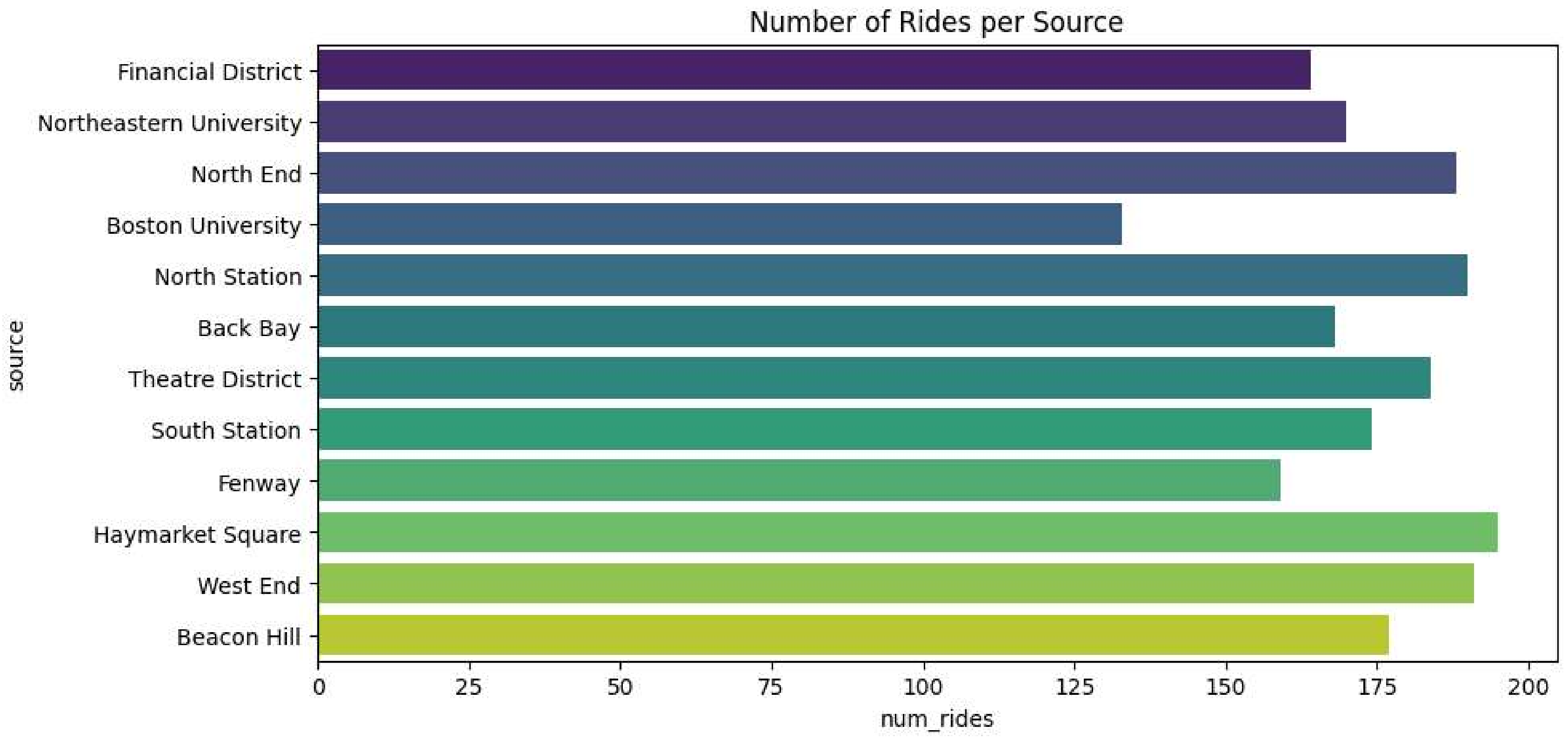
In [22]:
```
pdf_avg_price = avg_price_cab.toPandas()
pdf_max_distance = max_distance_cab.toPandas()
pdf_rides_source = rides_per_source.toPandas()
pdf_avg_surge = avg_surge_destination.toPandas()
```

In [23]:
```
plt.figure(figsize=(6,4))
sns.barplot(x='cab_type', y='avg_price', data=pdf_avg_price)
plt.title("Average Price per Cab Type")
plt.show()
```

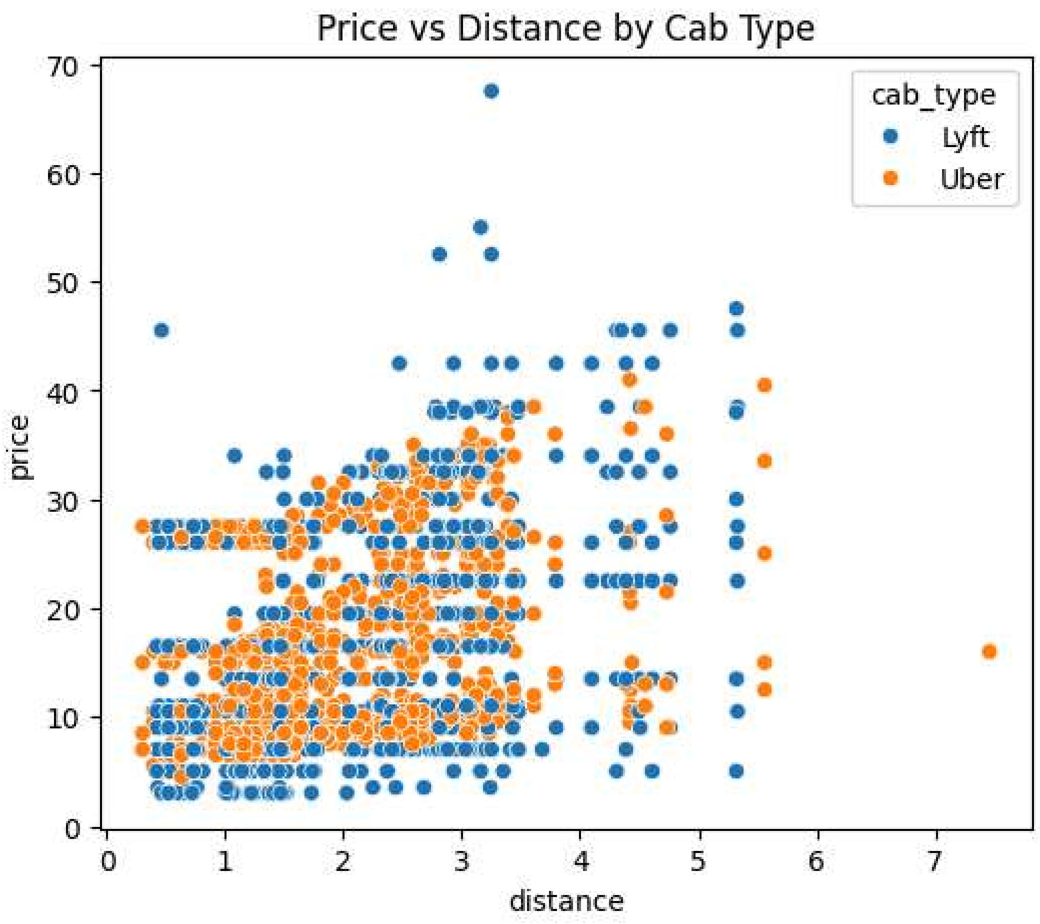


In [24]:
```
plt.figure(figsize=(10,5))
sns.barplot(x='num_rides', y='source', data=pdf_rides_source, palette="viridis")
plt.title("Number of Rides per Source")
plt.show()
```

```
C:\Users\Harini\AppData\Local\Temp\ipykernel_9356\2514970801.py:2: FutureWarning:

Passing `palette` without assigning `hue` is deprecated and will be removed in v0.14.0. Assign the `y` variable to `h
ue` and set `legend=False` for the same effect.

  sns.barplot(x='num_rides', y='source', data=pdf_rides_source, palette="viridis")
```



In [25]:
```
plt.figure(figsize=(6,5))
sns.scatterplot(x='distance', y='price', hue='cab_type', data=df.toPandas())
plt.title("Price vs Distance by Cab Type")
plt.show()
```



In [27]:
```
# Most expensive cab type on average
expensive_cab = pdf_avg_price.loc[pdf_avg_price['avg_price'].idxmax(), 'cab_type']
print(f"The most expensive cab type on average is: {expensive_cab}")

# Source with highest number of rides
top_source = pdf_rides_source.loc[pdf_rides_source['num_rides'].idxmax(), 'source']
print(f"The source with highest number of rides is: {top_source}")

# Destination with highest average surge
top_surge_destination = pdf_avg_surge.loc[pdf_avg_surge['avg_surge'].idxmax(), 'destination']
print(f"The destination with highest average surge multiplier is: {top_surge_destination}")
```

```
The most expensive cab type on average is: Lyft
The source with highest number of rides is: Haymarket Square
The destination with highest average surge multiplier is: Back Bay
```

```
In [ ]:
```