UNIVERSITY OF GHANA

MASTER OF SCIENCE IN DATA SCIENCE

DSCD 611: Programming for Data Scientists 1- Final Project

Department of Computer Science

GROUP A14

Topic

Uber Request Fulfilment, Problem-Driven Exploratory Analysis

S/N	STUDENT NAME	STUDENT ID
1	**Silas Yakalim**	**22424586**
2	**Michael Etornam Kojo Agbenyegah**	**22425717**
3	**Emmanuel Asante**	**22424587**
4	**Benjamin Ofori**	**22424701**

Overview

Unmet Uber trip requests, those ending as Cancelled or No Cars Available, represent a critical operational failure mode for app-based taxi services. Such failures reduce realised revenue, erode user trust, and may reflect misalignment between driver supply, dispatch practices, and spatiotemporal demand. Exploratory data analysis provides a practical evidence base for diagnosing these patterns by revealing how fulfilment outcomes vary across time and location, and by highlighting recurring periods of concentrated service shortfall that have clear operational significance.

Data description and analytical approach

The analysis was conducted using the Uber Request Data dataset, which captures individual ride requests and their outcomes. Each observation represents a single request and includes a unique request identifier, pickup point (City or Airport), request status (Trip Completed, Cancelled, or No Cars Available), timestamps for when the request was made and when the trip ended. These timestamp variables enable the derivation of temporal features such as hour of day, weekday, and date, which support the investigation of demand patterns and unmet-demand hotspots.

For the analytical approach, mixed-format timestamps were parsed into a consistent datetime format, and unmet demand was defined as any request not resulting in a completed trip.

Research questions

- What proportion of requests are completed vs unmet, and what is the dominant failure mode?
- At which hours is the demand, supply gap (Requests − Completed) maximal?
- Do outcome rates differ by pickup point (City vs Airport)?
- Are there recurring weekday×hour hotspots for unmet demand?

Data Analysis

What proportion of requests are completed vs unmet, and what is the dominant failure mode?

Across 6,745 requests, it was observed that 2,831 were completed (41.97%). The remaining 3,914 requests (58.03%) were unmet, comprising 1,264 cancellations (18.74%) and 2,650 ‘No Cars Available’ outcomes (39.29%). ‘No Cars Available’ suggests supply scarcity, whereas ‘Cancelled’ may reflect behavioral responses to long wait times or matching frictions.

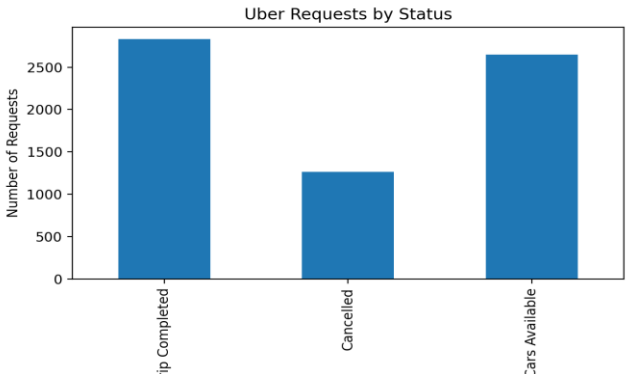

Figure 1. Status distribution.

At which hours is the demand-supply gap (Requests - Completed) maximal?

Let $\text{Gap}(h) = \text{Requests}(h) - \text{Completed}(h)$. The largest demand–supply shortfall occurs at hour 18, where the gap reaches 346 requests. This period, and the surrounding peak hours, therefore represents the most leverageable window for supply-side interventions, including targeted driver incentives, shift realignment, and dynamic pricing strategies such as surge pricing.

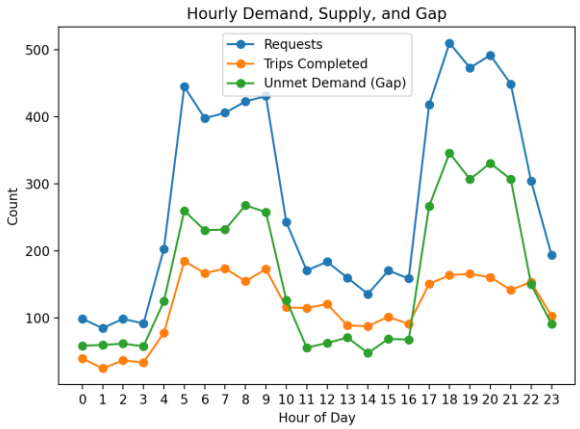

Figure 2. Hourly demand, supply, and gap.

Do outcome rates differ by pickup point (City vs Airport)?

At the Airport pickup point, 40.98% of requests were completed, 6.11% were cancelled, and 52.90% resulted in *No Cars Available*. In contrast, City requests showed a slightly higher completion rate (42.89%), but a markedly higher cancellation rate (30.40%), with 26.72% ending as *No Cars Available*. Overall, Airport requests are characterised by a substantially higher *No Cars Available* rate, which is consistent with localized supply constraints or driver reluctance to serve airport trips, whereas City requests are more affected by cancellations, suggesting behavioural responses or matching frictions.

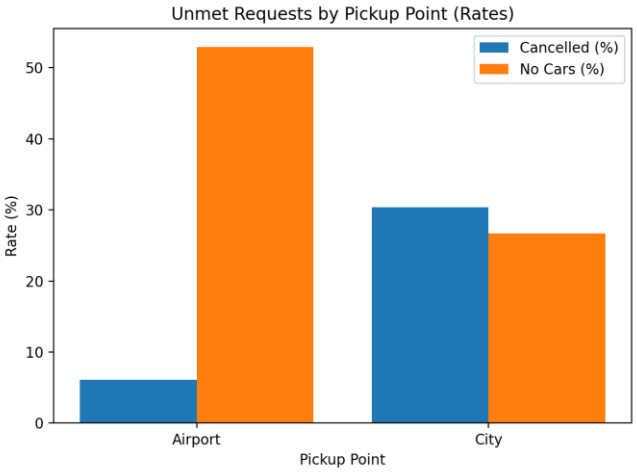

Figure 3. Unmet composition by pickup point.

Are there recurring weekday x hour hotspots for unmet demand?

The largest aggregate shortfall occurs on 2016 07-14, with a total gap of 823 requests. In addition, the weekday–hour heatmap highlights recurring hotspots, demonstrating that unmet demand is not randomly distributed but instead concentrates within predictable temporal windows.

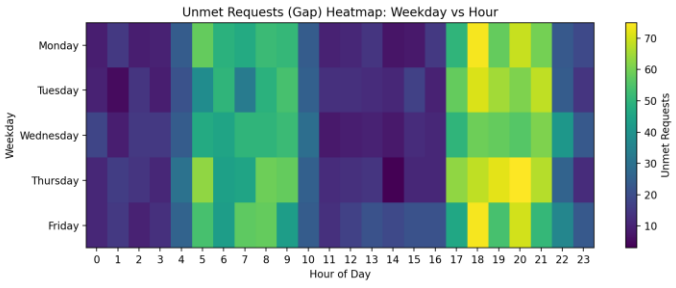

Figure 4. Hotspot heatmap (weekday x hour).

Discussion and recommendations

Taken together, the finding indicate that unmet demand is both substantial and systematically patterned. The predominance of No Cars Available outcomes suggests that insufficient driver supply is the primary operational constraint. Moreover, the temporal analyses demonstrate that the demand–supply mismatch is concentrated within peak periods, rather than being evenly distributed across the day. Finally, the marked differences between pickup points imply that a single uniform policy is unlikely to be optimal; instead, interventions should be location-specific, combining airport-focused supply management (e.g., staging, queuing, and targeted incentives) with cancellation-reduction strategies in the city (e.g., improving matching efficiency, reducing wait times, and enhancing ETA accuracy).

Actionable recommendations

- Implement time-targeted incentives and/or surge mechanisms during peak-gap windows, prioritising the highest-gap hours.
- Introduce airport staging/queue management and airport-specific incentives to reduce No Cars Available outcomes.
- Reduce cancellations by focusing on wait-time reduction, including matching improvements and driver rebalancing during high-cancellation periods.
- Establish ongoing monitoring and evaluation, tracking status distributions, hourly gaps, and weekday–hour hotspots over time, and assessing intervention impact using pre/post comparisons.
- Limitations and future work