Part 2 - Experiment and metrics design

The neighboring cities of Gotham and Metropolis have complementary circadian rhythms: on weekdays, Ultimate Gotham is most active at night, and Ultimate Metropolis is most active during the day. On weekends, there is reasonable activity in both cities.

However, a toll bridge, with a two way toll, between the two cities causes driver partners to tend to be exclusive to each city. The Ultimate managers of city operations for the two cities have proposed an experiment to encourage driver partners to be available in both cities, by reimbursing all toll costs.

1) What would you choose as the key measure of success of this experiment in encouraging driver partners to serve both cities, and why would you choose this metric?

Currently, drivers who work night hours are most likely to work in Gotham, while drivers who work day hours are most likely to work in Metropolis. This means during the weekdays, there are limited drivers available during daytime in Gotham or nighttime in Metropolis.

If reimbursing toll costs successfully encourages drivers to begin serving both cities, we should expect to see increased driver activity during non-peak hours for each city. Essentially, day drivers who primarily work in Metropolis would be more willing to cross the toll bridge to pick up a passenger in Gotham, and vice versa.

This can be measured either by:

a) measuring the number of trips taken across the toll bridge before and after this change, and if there is an increase, testing whether the increase in traffic is consistent with the number of reimbursement requests.

b) comparing the total number of trips taken (segmented by location and time), in which case we can see whether this change has more of an impact on one city/time versus the other. (e.g. are daytime drivers more willing to travel between cities to pick up passengers?)

2) Describe a practical experiment you would design to compare the effectiveness of the proposed change in relation to the key measure of success. Please provide details on:

a) how you will implement the experiment

- Begin by getting a sense of current traffic patterns and market. Are rides requested consistent across all weekdays? How different are weekends from

weekdays? What do hourly patterns look like? Day of week? Seasonality? Do both cities have equal supply/demand?

- Assuming there are no external factors at play, and all above considerations are equal between cities, this change can begin by being implemented for the duration of one season.
- Each month, the number of trips taken across from the toll bridge will be compared to the average number of trips prior to this change. This difference will be compared to the number of requested reimbursements.
- If there is a noticeable difference found in the prior step, it will be worth looking into city and time factors in more detail. Are the number of paid trips actually increasing, or are drivers crossing the bridge without any luck in finding new passengers? Are drivers more willing to cross the bridge at a certain time of the day?

b) what statistical test(s) you will conduct to verify the significance of the observation

For the first metric, a t-test can be used to compare the mean number of trips across the toll bridge before and after the change was implemented. If there is a statistically significant difference, we can ensure this is specifically due to our change by referring to the number of reimbursement requests.

If the above conditions are met, we can proceed with a Chi-Square test to compare the difference in average number of trips within each city and time of day, as such:

		City	
		Gotham	Metropolis
Time of Day	Night	*n*	*n*
	Day	*n*	*n*

c) how you would interpret the results and provide recommendations to the city operations team along with any caveats.

If no statistically significant difference is found in the mean number of trips over the toll bridge, reimbursements need not continue after the end of the season.

If there is a statistically significant difference, then specific recommendations will differ based on the results of the Chi-Square test. If either time of day or city has a statistically significant impact, then drivers can be either reimbursed for trips made at

a specific time of the day, or can be reimbursed for trips made into one city. Or, if there is no significant difference across each group, the city can continue reimbursing drivers for all trips made across the toll booth.