

1) Key Measure of Success:

The key measure of success for encouraging driver partners to serve both cities would be the increase in the number of driver partners crossing the toll bridge and actively providing ride services in both Gotham and Metropolis on weekdays. This metric is important because it directly reflects the desired behavior of driver partners being available in both cities, overcoming the current exclusivity caused by the toll bridge. By monitoring the increase in cross-city activity, we can assess the success of the experiment in achieving its goal.

2) Practical Experiment Design:

a) Implementation of the Experiment:

To implement the experiment, the Ultimate managers would need to first announce the toll reimbursement policy to all driver partners. They should track the toll expenses incurred by each driver partner when crossing the bridge while providing rides in the neighboring city. The reimbursement process should be straightforward and efficient to ensure drivers are not discouraged by cumbersome procedures.

b) Statistical Test(s) to Verify the Significance of the Observation:

To compare the effectiveness of the toll reimbursement policy, the experiment should be conducted as an A/B test with two groups: the control group (Group A) and the experimental group (Group B).

1. Group A (Control Group): This group consists of driver partners who are not reimbursed for toll expenses and continue to operate as usual, exclusively serving their respective cities.

2. Group B (Experimental Group): This group consists of driver partners who are informed about the toll reimbursement policy and encouraged to serve both cities by crossing the toll bridge, with their toll expenses being reimbursed.

The experiment should run for a reasonable duration, such as a month or more, to allow for enough data collection.

The statistical test used to analyze the results could be a hypothesis test. The null hypothesis (H_0) would be that there is no significant difference in the number of driver partners serving both cities between the control and experimental groups. The alternative hypothesis (H_1) would be that there is a significant increase in cross-city activity in the experimental group compared to the control group due to the toll reimbursement policy.

c) Interpretation of Results and Recommendations:

After the experiment period, the data collected from both groups should be analyzed to determine if there is a statistically significant difference in cross-city activity between the control and experimental groups. The appropriate statistical test for this scenario would be the chi-squared test, which can assess whether there is a significant association between categorical variables (e.g., cross-city activity) in different groups.

If the chi-squared test yields a statistically significant result (i.e., $p\text{-value} < 0.05$), it would indicate that the toll reimbursement policy has had a significant effect on encouraging driver partners to serve both cities. In this case, the city operations team should consider continuing the toll reimbursement policy as a permanent measure to facilitate increased cross-city activity and improve transportation options for residents in both Gotham and Metropolis.

However, there are some caveats to consider:

1. **Sample Size:** Ensure that the sample size of driver partners in both groups is large enough to make meaningful conclusions. A larger sample size will provide more reliable results.
2. **Weekends vs. Weekdays:** The experiment focuses on weekdays since that's when the complementary circadian rhythms are most pronounced. Ensure that weekends are not affected significantly, as reasonable activity is already present during that time.
3. **Other Factors:** While the toll reimbursement policy is a significant incentive, there could be other factors influencing driver behavior, such as traffic conditions, weather, and surge pricing. The analysis should consider these factors to ensure accurate conclusions.
4. **Long-term Impact:** Consider monitoring the long-term impact of the toll reimbursement policy on driver behavior and city operations. It may be helpful to track data over several months to assess whether the effects are sustained and whether there are any unforeseen consequences.

By considering these factors and carefully analyzing the results, the city operations team can make well-informed decisions regarding the toll reimbursement policy and its potential benefits for both cities.