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?*

I would select the total amount of tolls collected as the key measure for success. This is because if a driver was to be available in both cities, it would necessitate that he or she would have to cross the bridge and thus pay a toll. Therefore, a high amount of tolls collected implies that there was a higher increase in the number of cars traveling between both cities (the reverse is also true: lower toll totals suggests that the drivers are remaining exclusive to their respective cities)

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:*

- *how you will implement the experiment*
- *what statistical test(s) you will conduct to verify the significance of the observation*
- *how you would interpret the results and provide recommendations to the city operations team along with any caveats.*

Our experiment features a control period and an experimental period. In the control period, the bridge would run as normal for 30 days. In the experimental period, the two cities would begin its "reimbursement" test and announce to the drivers of both cities that the bridge will now reimburse all tolls for the next 30 days. Then the city planners will collect the data on the amount of tolls collected throughout each day in both periods and separate the data based on whether it was a weekday or a weekend.

<u>Weekend Testing:</u>
For the days that fall on the weekend, we will use a One-Tailed Student's T-Test to determine if the average tolls collected on the weekend days in the reimbursement period is significantly higher than the average tolls collected on the weekend days in the control period. If the p-value is less than our selected significance value, then we reject the null hypothesis. This result means that the reimbursement program is increasing the intercity traffic and if this is the case, the recommendation would be to **implement the toll reimbursement on weekends**.

<u>Weekday Testing:</u>
Since the two cities have complementary circadian rhythms, this means that there are likely two peak periods (one in the daytime and one at nighttime) in which drivers would need to cross the bridge in order to catch each city when they are at their peak activity level. We would thus expect a **bimodal distribution**. To account for this, we'll split the weekday data into two parts: Weekday Daytime (e.g. 6:00 AM to 6:00 PM) and Weekday Nighttime (e.g. 6:00 PM to 6:00 AM). We'll then run the same one-tailed student's t-test on both sets of data like we did with the Weekend data. If we can successfully reject the null hypothesis on both of these subsets, then there is even stronger evidence that the toll reimbursement program is making a real difference and we would thus recommend **implementing the toll reimbursement on weekdays.**

Caveats:

The important caveat to note with either of these results is that there are inevitably seasonal trends which affect our control period and experimental period. In other words, because each period runs for 30 days, they approximately take place across two different months so a difference between the average tolls collected could be influenced by the fact that there is simply more intercity activity in one month over the other, a confounding variable in our experiment. Another caveat is that the experiment assumes that drivers will instantly know that tolls are being reimbursed during the experiment period - if the city planners do not adequately spread the word to its driver partners about when tolls will be reimbursed, then that would likely impact the validity of the data.