**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?

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

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

observation

c. how you would interpret the results and provide recommendations to the city

operations team along with any caveats.

**Answers:**

Before answering these questions, I will make a couple of assumptions since I could not get an answer from Springboard:

1. I will assume this exercise is related to a driving app such as Uber or Lyft.
2. I will assume this is a hypothetical question and it is not related to any of the datasets provided for this challenge, as I can’t find a relationship between this exercise and the actual data provided.

**Question 1:**

I could choose two different metrics that would include a few variables:

I could have a metric that tracks when a driver rejects a customer: what the pickup location was and where the driver was. These can be coordinate locations in a tuple (for example: ((1,2), (3,4)) tuple one being customer coordinates and tuple two driver coordinates). Then, by creating coordinate bounding boxes, we can separate the two cities and compare our tuples to them. If each tuple belongs to a different bounding box, then we know the driver is rejecting to drive to a different city. We can also track which city the driver is refusing to drive to.

The other metric can be generated once the driver picks up/drops off the passenger. This ‘location’ metric will allow us to track where each driver has been, as well as where the passengers are going, and if the driver has gone from one city to the other.

I should note that, while I could be that drivers from one city refuse to take trips to another city, this could also be due to passengers not needing to go over to the other city (aka there is no demand from one city to the other), but I will assume that this has already been studied and there is a significant demand.

**Question 2:**

1. The incentive is no toll fee, so we just need to make sure all the drivers know this and track their behavior (Again, this assumes there is equal demand in both cities at all times).
2. Since we would have the data for all the population, we wouldn’t need a statistical question to infer significance of the observation. We could just compare before and after. Now, assuming we get just a sample of the population, our null hypothesis will be that there is no actual change in behavior. The p-value will be calculated using t-score if we don’t know the population std, and z-score if we know it (population mean needs to be known in both cases, otherwise, non-parametric test will be required). If p-value is less than 0.05, we reject null hypothesis.
3. Assuming we have rejected our null hypothesis (aka there is a change in behavior), and based on our metrics described in question 1, we could safely recommend that the tolls are eliminated to encourage driver partners to serve both cities equally.