

Ultimate Challenge

Part I: See Jupyter Notebook Ultimate Challenge 1

Part 2:

1. This depends on what is classified as success. To see if the experiment is a success, it could be as simple as recording whether or not the bridge is accessed more when the toll reimbursement promotion is active. If more driver partners are no longer exclusive, then more cars will be driving across the bridge, because if a driver partner goes across the bridge during the day for Metropolis, then he would drive back to Gotham for the night, and vice versa for someone who originated in Metropolis.

To see if it is successful in the sense that performing this promotion helps both the driver partners and the people using these, there are various metrics for success. The first and foremost would be that **driving partners are accepting more rides**. Without the limitation of staying on one side of the bridge, each driver should get more rides in. Another metric for success of the promotion is to check on **the wait times** of the rider. If more cars are utilizing the promotion, then there will be more accessible drivers during the day and night. And finally, the real metric that matters to us is the overall **revenue** and see if it has increased, because more rides might not necessarily mean more revenue if the toll reimbursement is too expensive.

2. For many of these metrics, I would need access to the driver partners' data. So for checking for any increase, such as whether or not more rides are being taken/accepted and the average wait time, I can do a hypothesis test where the Null is that there is no change in either, and the alternate is that the mean wait time or the mean number of rides has increased. These would both be a hypothesis test for means. The same type of test can be used to check whether or not more people are using the bridge per day.

I would collect about a month of data from before the promo started, and then run the promo for a month before checking the effectiveness of it. With the data, I can check to see if the means have actually changed by finding a 95% confidence interval of the old data and checking to see if the new mean is within this interval or not. I can do this by either bootstrapping the old data with replacement to simulate gathering data for thousands of days, or I could use the equation $\tilde{x} + z(\frac{s}{\sqrt{n}})$, where \tilde{x} is the sample mean of either the wait time, number of times the bridge is used, or the number of rides taken. z is the approximate z-stat for a 95% confidence interval, s is the sample standard deviation for any of these metrics, and n is the number of observations, which in our case would be 30, for each day.

As for revenue, we can take what they earned after the tolls have been reimbursed and see if there is any change, the same way we checked the other metrics. If it decreased or stayed the same, then

I would of course recommend that they do not continue with this promotion, as it is not useful, but if it does increase revenue, then we should keep running the experiment for a while longer to make sure that it is effective in allowing people to use the toll-bridge for drive partners.

Part 3: See Jupyter Notebook Ultimate Challenge 3