

## Ultimate challenge

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?**

**Ans :** Here Key measure of success of experiment could be if company would be able to get the revenue gain of some percentage(lets consider 30-60%) from the previous revenue before implementing the change.

By reimbursing the 2-way toll amount, Ultimate can encourage the drivers to get more riders.

- 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:**

**Ans :** We can perform a statistical test like right tailed T-paired test on data of revenue over a period of few months before and after implementing the change .

- a) how you will implement the experiment**

**Ans :** here first we need to set how much confidence we want in our experiment to be true , lets say 95% , so we can set alpha level as .05 or by how much percent company wants a percentage revenue gain .

Then we need to first gather the data for few months before and after implementing the change or get the data using bootstrap method to perform statistical test

**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.**

**Ans :**

We can perform a paired right tailed T- test on the data of revenue over the period of few months before and after the change to check if there is any positive change after the experiment.

1. We can setup a null hypothesis that there would be no effect on revenue after the change i.e  $(\text{mean-before} - \text{mean-after}) = 0$
2. Now considering “Data\_before” is the sample data of revenue before implementing the change over the period of 6 months and “Data\_after” is the data of revenue after the change over the period of 6 months and Now we will calculate the difference between each pair of sample i.e If  $x_1, x_2, x_3 \dots x_n$  is the revenue before the change , and  $y_1, y_2, y_3 \dots y_n$  is the data of revenue after the change .  
now we calculate mean of this difference series ie  $(\text{mean\_after})$
3. Now we need to calculate the t-score using formula :  
$$T = (\text{mean\_after}) - (\text{hypothesized\_mean}(=0)) / (s(\text{std of the sample of differences}) * \sqrt{n(\text{size of sample})})$$
4. Here we will perform a right tailed t-test to check how far the t-score from the hypothesized mean.
5. So our critical region would be right tail 5% of the distribution.  
So if t-score is greater than the critical value i.e (t-score at 95% with df-5 i.e 2.015) then we will reject the null hypothesis otherwise we will accept the null hypothesis.
6. Here Ultimate corp. can expect the revenue to be  $(\text{mean\_after})(\pm)\text{margin of error}$  i.e our confidence interval

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

**Ans :** So it depends on by how much company wants revenue gain, if it is close to the mean difference(+/-) margin\_of\_error ( i.e the confidence interval )then company would consider this test successful

We can perform a Chi-square test also to see the goodness of fit. Let's consider critical value (alpha) to be 5%.

Here we will set the null hypothesis that the results are by chance and not significant and alternative hypothesis is that results are significant.

If the p-value comes out to be greater than or equal to significance level(.05) than we will fail to reject the null hypothesis that the results are by chance And if p-value comes out to be less than critical value than we will fail to reject the null hypothesis and accept the alternative hypothesis.

**Caveats** might be Ultimate would require more drivers to perform this test as if a driver serves during the day , he may not serve during the night and vice versa .