Department of Computer Science and Engineering (Data Science)

Subject: Applied Data Science (DJ19DSL703)

Experiment - 8

(A/B Testing)

Name: Rishabh Patil
SapID:60009200056
Branch:D12

Aim: To prepare a case study on A/B Testing.

Theory:

A/B Testing:

A/B testing is one of the most important concepts in data science and in the tech world in general because it is one of the most effective methods in making conclusions about any hypothesis one may have. It's important that you understand what A/B testing is and how it generally works.

A/B testing is a common methodology to test new products or new features, especially regarding user interface, marketing and e-commerce. The main principle of an A/B test is to split users into two groups; showing the existing product or feature to the control group and the new product or feature to the experiment group. Finally, evaluating how users respond differently in two groups and deciding which version is better. Even though A/B testing is a common practice of online businesses, a lot can easily go wrong from setting up the experiment to interpreting the results correctly.

A/B testing is a form of statistical and two-sample hypothesis testing. Statistical hypothesis testing is a method in which a sample dataset is compared against the population data. Two-sample hypothesis testing is a method in determining whether the differences between the two samples are statistically significant or not.

Formulate your hypothesis:

Before conducting an A/B testing, you want to state your null hypothesis and alternative hypothesis:
The null hypothesis is one that states that sample observations result purely from chance. From an A/B test perspective, the null hypothesis states that there is no difference between the control and variant group.

The alternative hypothesis is one that states that sample observations are influenced by some non-random cause. From an A/B test perspective, the alternative hypothesis states that there is a difference between the control and variant group.

When developing your null and alternative hypotheses, it's recommended that you follow a PICOT format.

PICOT stands for:

- Population: the group of people that participate in the experiment
- Intervention: refers to the new variant in the study
- Comparison: refers to what you plan on using as a reference group to compare against your intervention
- Outcome: represents what result you plan on measuring
- Time: refers to the duration of the experience (when and how long the data is collected)

Example: "Intervention A will improve anxiety (as measured by the mean change from baseline in the HADS anxiety subscale) in cancer patients with clinical levels of anxiety at 3 months compared to the control intervention."

Does it follow the PICOT criteria?
Population: Cancer patients with clinical levels of anxiety
Intervention: Intervention A
Comparison: the control intervention
Outcome: improve anxiety as measured by the mean change from baseline in the HADS anxiety subscale
Time: at 3 months compared to the control intervention.

Yes, it does — therefore, this is an example of a strong hypothesis test.

Create your control group and test group

Once you determine your null and alternative hypothesis, the next step is to create your control and test (variant) group. There are two important concepts to consider in this step, random samplings and sample size.

Random Sampling
Random sampling is a technique where each sample in a population has an equal chance of being chosen. Random sampling is important in hypothesis testing because it eliminates sampling bias, and it's important to eliminate bias because you want the results of your A/B test to be representative of the entire population rather than the sample itself.
Sample Size
It's essential that you determine the minimum sample size for your A/B test prior to conducting it so that you can eliminate under coverage bias, bias from sampling too few observations.

Conduct the test, compare the results, and reject or do not reject the null hypothesis:

Once you conduct your experiment and collect your data, you want to determine if the difference between your control group and variant group is statistically significant. There are a few steps in determining this:
First, you want to set your alpha, the probability of making a type 1 error. Typically, the alpha is set at 5% or 0.05
Next, you want to determine the probability value (p-value) by first calculating the t-statistic using the formula above.
Lastly, compare the p-value to the alpha. If the p-value is greater than the alpha, do not reject the null!

Department of Computer Science and Engineering (Data Science)

Lab Assignment:

Prepare a case study based on data science project to formulate an A/B testing.

Title: Case Study on Optimizing User Engagement through A/B Testing in a E-commerce Platform

1. Background:
Let XYZ Inc., be a leading e-commerce platform, which has observed a decline in user engagement on their product pages over the past few months. To address this issue and enhance the user experience, the data science team decided to conduct an A/B testing experiment.

2. Problem Statement:
The goal of team is to identify changes which will increase user engagement on product pages, leading to improved conversion rates and increased revenue.

3. Formulating Hypotheses:
Null Hypothesis (H0): There is no significant difference in user engagement between the current product page design (Control Group) and the proposed design changes (Test Group).

Alternative Hypothesis (H1): The proposed design changes in the Test Group will lead to a significant increase in user engagement compared to the Control Group.

4. PICOT Format:
Population: Users visiting product pages on the e-commerce platform.
Intervention: Implementing design changes on the product pages.
Comparison: Current product page design without changes.
Outcome: User engagement metrics such as time spent on the page, click-through rates, and conversion rates.
Time: The duration of the A/B testing experiment.

5. Experimental Design:
a. Control Group: Randomly selected users who will experience the current product page design without any changes.
b. Test Group: Randomly selected users who will experience the product pages with the proposed design changes.
c. Random Sampling: Users will be randomly assigned to either the Control or Test Group to ensure unbiased representation.

6. Implementation:
a. The data science team collaborates with the development team to implement the design changes on the Test Group product pages.
b. The A/B testing tool is set up to randomly assign users to either the Control or Test Group.
c. Data collection begins, capturing user engagement metrics for both groups.

7. Conducting the Test:

a. Monitor and record user engagement metrics for the Control and Test Groups over the predefined duration of the experiment.
b. Ensure that external factors that may influence user engagement are monitored and controlled for.

8. Analyzing Results:
a. Perform statistical analysis (e.g., t-tests or chi-square tests) to compare user engagement metrics between the Control and Test Groups.
b. Evaluate the significance level and determine if there is a statistically significant difference.
c. Consider practical significance and interpret the results in the context of the business goals.

9. Drawing Conclusions:
a. If the results are statistically and practically significant, implement the design changes on the entire platform.
b. If the results are inconclusive, reevaluate the design changes and consider additional A/B testing or adjustments.

10. Documentation and Reporting:
a. Compile a comprehensive report documenting the entire A/B testing process, including hypotheses, experimental design, results, and conclusions.
b. Share findings with relevant stakeholders, including the development team, product managers, and executives.

11. Iteration and Continuous Improvement:
a. Use the insights gained from the A/B testing to inform future design and development decisions.
b. Establish a framework for continuous improvement based on data-driven decision-making.