**Task**

You should follow the structure identical to the one in the hands-on task. Analyze the A/B test and provide recommendations.

Some notes:

* The dataset is aggregated by LocationID, PromotionID, and week. You should aggregate by LocationID and PromotionID before conducting the statistical tests.
* Since there are three marketing campaigns and you have to select the best-performing one, you will have to conduct several tests, comparing campaigns against one another. This kind of testing is known as pairwise comparisons, and it suffers from the [multiple testing problem](https://en.wikipedia.org/wiki/Multiple_comparisons_problem) - if we run a lot of tests, there’s an increased chance of getting a type I error (false positive). It is, therefore, suggested to use the confidence level of 99% instead of the traditional 95% in your graded task.

**Goal of the Test**

The primary goal of this A/B test is to identify which of the three marketing campaigns (each identified by a unique PromotionID) performs best in terms of long-term engagement.

For analysis of A/B test results we will use a confidence level of 99%. To avoid multiple testing problem (decreased chance of getting a type I error (false positive)).

**Target Metric**

The dataset provides only one metric:\* sales\_in\_thousands  
  
**Possible Bias**In the data set we can see that the:

1. Age of the company varies from 1 to 28 years

Each group’s sample size (n=43,47,47) is moderately large, so the **Central Limit Theorem** helps ensure that the distribution of the mean store ages is not heavily affected by minor deviations from normality. Before conducting any tests with the data I have checked if Company age is statistically significant by conducting an ANOVA test and found that p=0.45 > p=0.05. The results suggest **no significant difference** in store age among the three promotions, meaning it’s unlikely to bias my comparison of promotional effectiveness.

Here is the SQL for the data collection:

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1. Market size varies from Small to Large

A screenshot of a test results

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In the table I have found that there are 10 different market\_id’s and each are grouped into different market sizes. To check if it could impact the test I have Counted how many market\_id’s were added to the promotions and grouped them by the size. Below there is a picture of SQL code and the results. Afterwards I did a Chi square test to see if any group is more statistically significant than other and have found p=0.986821 > p=0.05. This suggests that the distribution of market sizes across promotions is not statistically significantly different.

Here is the SQL for the data collection **A screenshot of a computer

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**Hypothesis   
=** Promotions 1, 2, 3 are all making the same effect to the total sales in the selected locations

I first did the descriptive statistics to understand the data: A screenshot of a computer

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Then I calculated the t-score and after that did a t-test:  
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As the results have shown that the:

1. Group of promotion 1 and 2 were statistically significant as the p<0. 01
2. Group of promotion 1 and 2 were statistically insignificant as the p>0. 01
3. Group of promotion 2 and 3 were statistically insignificant as the p>0. 01

There for we can reject the null hypothesis as the group 1 and 2 were statistically significant to a 99 % confidence.

To decide which is better promotion 1 or promotion 2 I have raised and answered some questions:

1. Which Promotion Has Higher Sales? Since Promotion 1 has an average of 58.1, whereas Promotion 2 averages 47.3, Promotion 1 is yielding higher mean sales.
2. Is the Difference Statistically Significant? The p value was less than 0.01, This indicates that **Promotion 1’s higher mean** is **not** just due to random chance, but is statistically significant.

**Conclusion:**

Promotion 1 performs significantly better in terms of average sales compared to Promotion 2 at the 99% confidence level.