**Fast Food Marketing Campaign A\B Test**

1. **Problem**

The fast-food restaurant aims to introduce a new product to the market. However, the optimal promotion method is unclear. Therefore, an experiment was conducted using three different promotion methods across various locations and market areas.

1. **Objective**

Evaluate A/B testing results and determine which marketing strategy is most effective.

1. **Data Collection Method**

Different promotion methods were assigned to various location IDs across ten markets. The experiment lasted for four weeks. Data was collected weekly on sales per location for each promotion method. These data were stored in the BigQuery database.

1. **Target metric:**
   1. Market: The experiment was conducted in 10 different markets, with all three promotion types tested in each.
   2. Promotion Type: Information on which promotion type was used (three different methods were tested).
   3. Location: Stores were randomly assigned a promotion method.
   4. Total Sales: The sales amount per location and promotion method.
2. **Data Analysis:**
   1. Data Validation: Checked for duplicates and empty values.
   2. Data Extraction: Required data were extracted from the database using an SQL query (attached separately).
   3. Data Transfer: Data needed for analysis were transferred to an Excel file (see attached file).
3. **Calculations**

Three A/B tests were conducted, comparing all three promotion methods. A 99% confidence level was used for statistical reliability (p < 0.01). The calculations included average sales per promotion, the number of locations, standard deviation, the difference in average sales between promotions, standard error, t-value, degrees of freedom (df), and p-value.

1. **Results**
   1. Promotion1 vs Promotion2:

*Hypothesis H0* – No difference in average sales between Promotion1 and Promotion2.

*Hypothesis H1*– There is a difference in average sales between Promotion1 and Promotion2.

**Results:**

|  |  |  |  |
| --- | --- | --- | --- |
| Promotion type | Average Sales k. | Location count | Standard deviation |
| 1 | 232.39605 | 43 | 64.1128913 |
| 2 | 189.31766 | 47 | 57.9883894 |
| Diff. | 43.07839 |  |  |

* **SE**: 12.92818525
* **t-value**: 3.332129461
* **df**: 88
* **p-value**: 0.001261629

The results indicate a statistically significant difference between Promotion1 and Promotion2, favoring Promotion1. Thus, **H0 is rejected**.

* 1. Promotion1 vs Promotion3

*Hypothesis H0* – No difference in average sales between Promotion1 and Promotion3.

*Hypothesis H1*– There is a difference in average sales between Promotion1 and Promotion3.

**Results:**

|  |  |  |  |
| --- | --- | --- | --- |
| Promotion\_type | Average Sales k. | Location count | Standard deviation |
| 1 | 232.39605 | 43 | 64.11289 |
| 3 | 221.45787 | 47 | 65.53546 |
| Diff. | 10.93817 |  |  |

* **SE: 13.673805**
* **t-value: 0.799936387**
* **df: 88**
* **p-value: 0.425901793**

The p-value indicates no significant difference. Thus, **H0 cannot be rejected**.

* 1. Promotion2 vs Promotion3

*Hypothesis H0* – No difference in average sales between Promotion2 and Promotion3.

*Hypothesis H1* – There is a difference in average sales between Promotion2 and Promotion3

**Results:**

|  |  |  |  |
| --- | --- | --- | --- |
| Promotion\_type | Average Sales k. | Location count | Standard deviation |
| 2 | 189.31766 | 47 | 57.98839 |
| 3 | 221.45787 | 47 | 65.53546 |
| Diff. | 32.14021 |  |  |

* **SE: 12.76427043**
* **t-value: 2.517982751**
* **df: 92**
* **p-value: 0.013531461**

The p-value indicates no significant difference (p > 0.01). Thus, **H0 cannot be rejected.**

1. **Validity of the Study**

Validation checks were conducted to ensure the study was correctly executed. It was checked how the promotions were distributed across different markets, ensuring each market had trials for all promotions. However, discrepancies were observed:

* Market2 did not test promotion\_2, and promotion\_3 was tested in 5 locations.
* Market10 tested promotion\_3 significantly fewer times than promotion\_2.

Additional analysis of Market2:

|  |  |  |
| --- | --- | --- |
| Market2 Additional analyze | |  |
|  | Location qty |  |
| Promotion\_3 | 5 |  |
| Other | 1 |  |
|  |  |  |

* **SD: 0.19245009**
* **m: 0.494596731**
* **CI: -0.1612634 to 0.827930**
* **p: 0.8333**

The results indicate that the promotion distribution in **Market2 was statistically unreliable**.

Sales distribution across markets was also plotted to check for sales variability due to promotions. The analysis confirmed no outliers, suggesting potential sales variation due to promotions.

Additionally, a check was made whether the groups were correctly divided by location\_id into three groups.

**Results:**

|  |  |
| --- | --- |
| **Promotion type** | **Location qty** |
| 1 | 43 |
| 2 | 47 |
| 3 | 47 |
| **Total** | **137** |

* **SD: 0.040274806**
* **m: 0.103506252**
* **CI: 0.229827081 to 0.43684**

|  |  |  |
| --- | --- | --- |
|  |  |  |
| P(Promotion\_1) | 0.313868613 |  |
| P(Promotion\_2) | 0.343065693 |  |
| P(Promotion\_3) | 0.343065693 |  |

We can see that the groups were divided correctly and statistically reliably by the number of locations.

1. **Summary of Results**

The statistical analysis revealed that only Promotion1 showed a significant difference in sales compared to Promotion2. However, there was no significant difference between Promotion1 and Promotion3, despite higher sales for Promotion1. Additionally, the experiment was not adequately distributed across markets, leading to unreliable conclusions.

1. **Recommendations**

Given the data, it is recommended to repeat the experiment with a proper design, ensuring equal distribution of promotions across markets to achieve more reliable results. However, if immediate action is necessary, Promotion1 should be used, as it showed a significant increase in sales compared to Promotion2 and had a higher average sales than Promotion3, despite the difference not being statistically significant.