

A/B Testing: Marketing Campaign

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Project Overview

A **fast-food chain** has a total 137 stores with **three market size types**

It plans to add a **new item** to its menu

The new item is introduced in the store in several **randomly selected market types**

Project Overview

Which promotion has the greatest effect on sales?

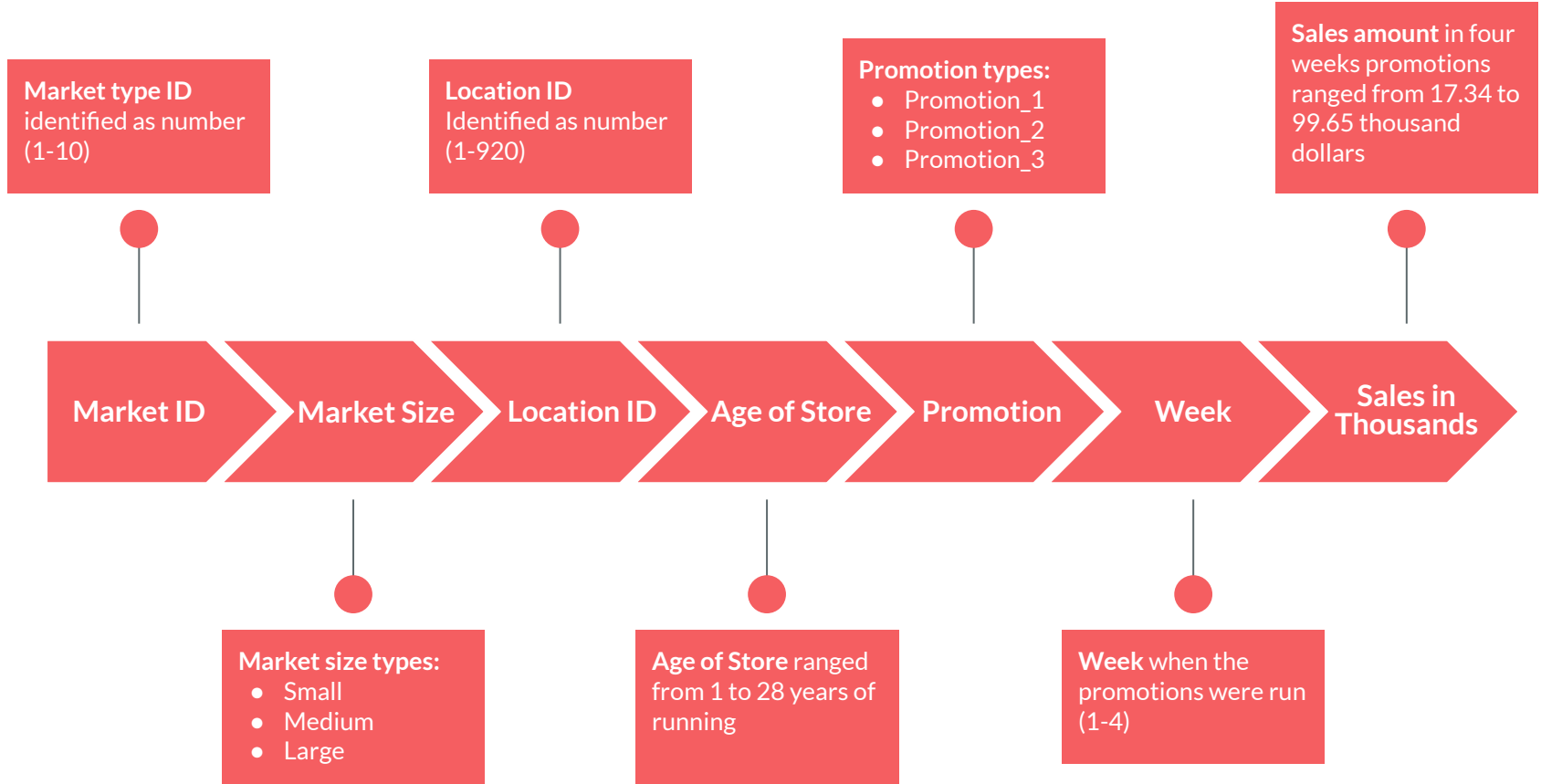
Possible marketing campaigns for promoting the new item still undecided

Three different promotions implemented at different location and the weekly sales of the new item are recorded for **the first four weeks**

The **mean of the sales** amount is 53.5 thousand dollars

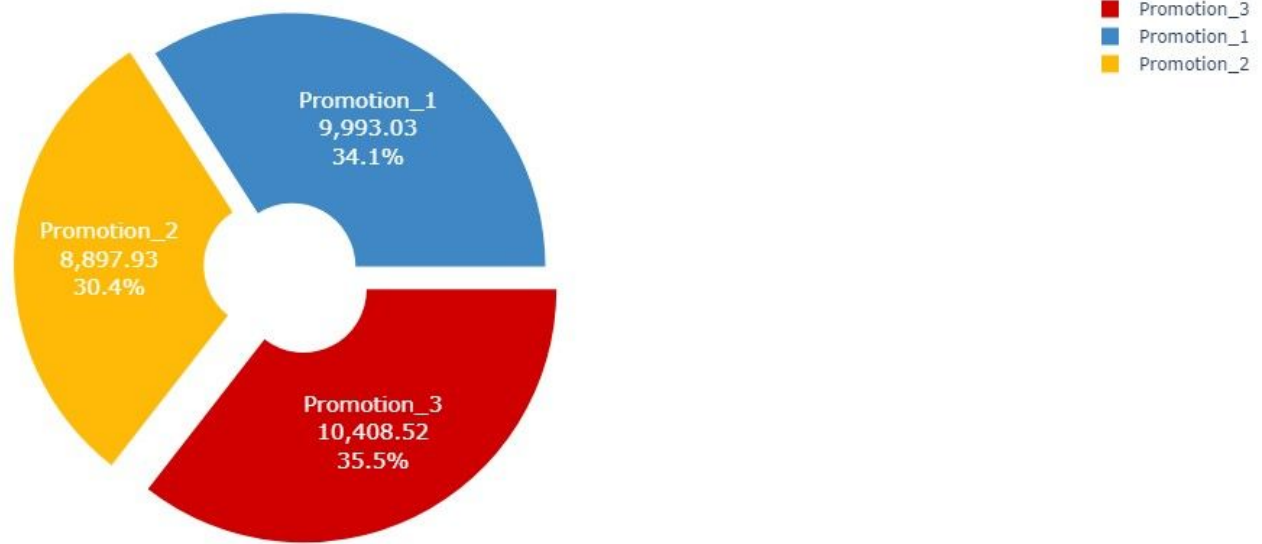
Data Sources: Fast Food Marketing Campaign

548 entries, 7 columns



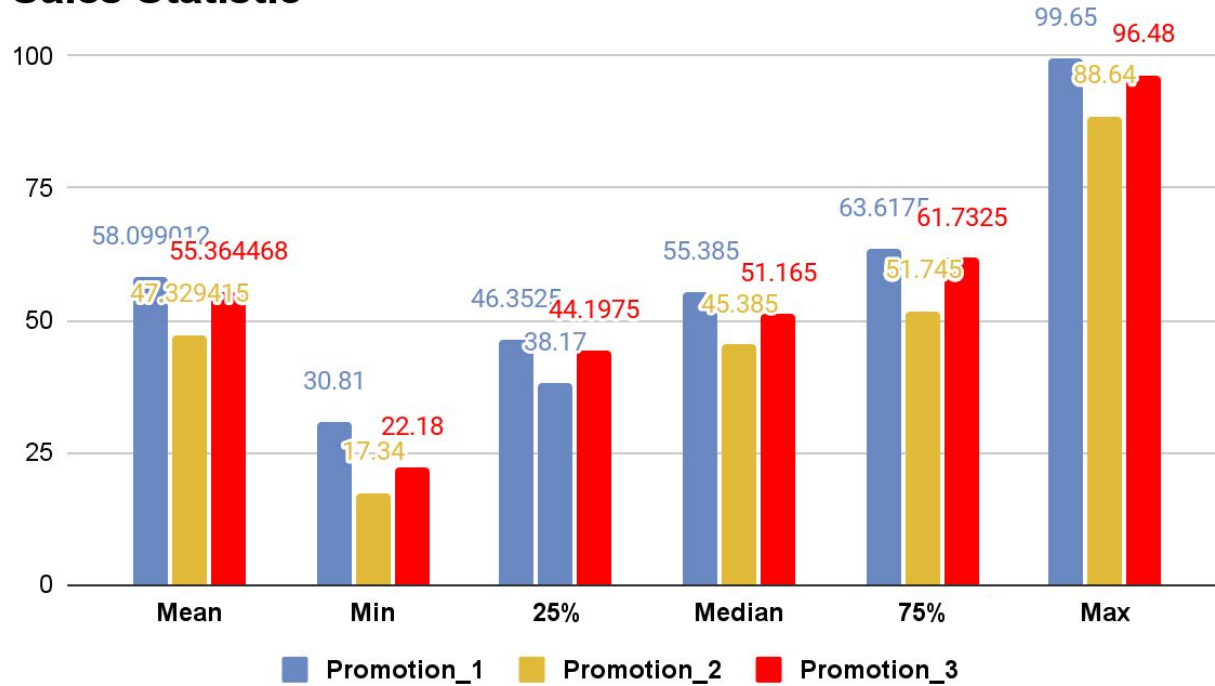
Exploratory Data Analysis

Sales Distribution by Different Promotions



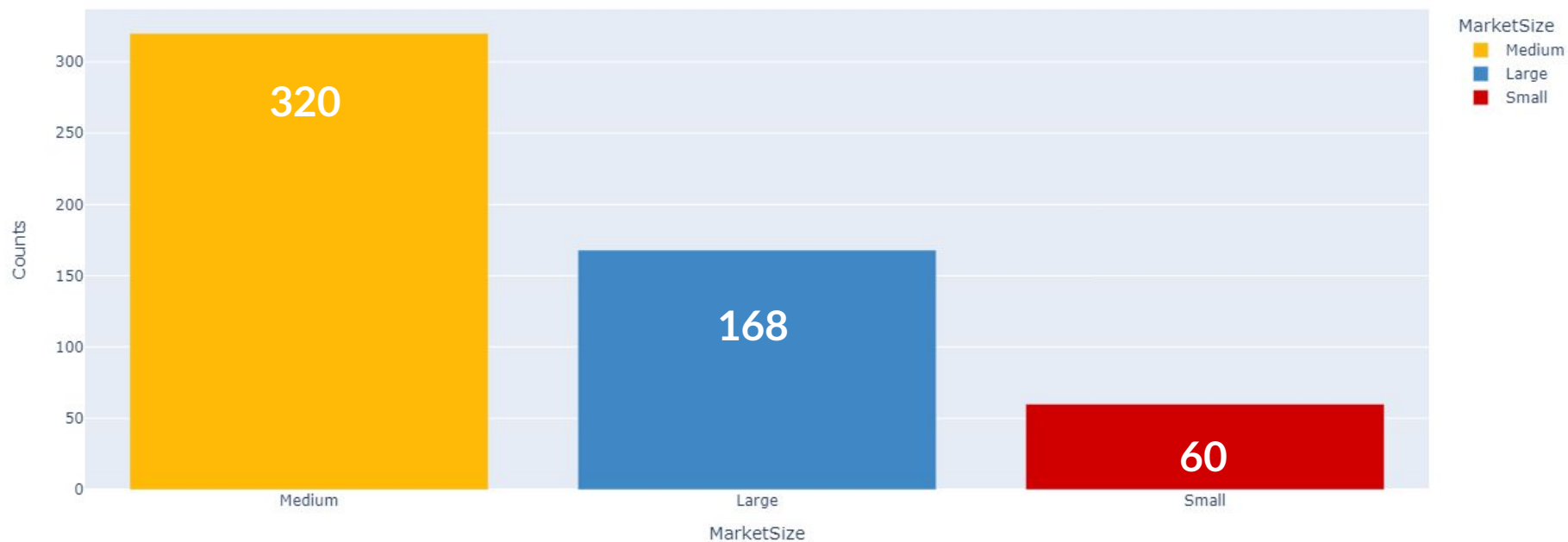
The highest sales distribution comes from Promotion_3 covered 35.5% of total sales with 10,408.52 thousand dollars meanwhile by Promotion_1 and Promotion_2 less than 10,000 thousand dollars in four weeks promotion

Sales Statistic



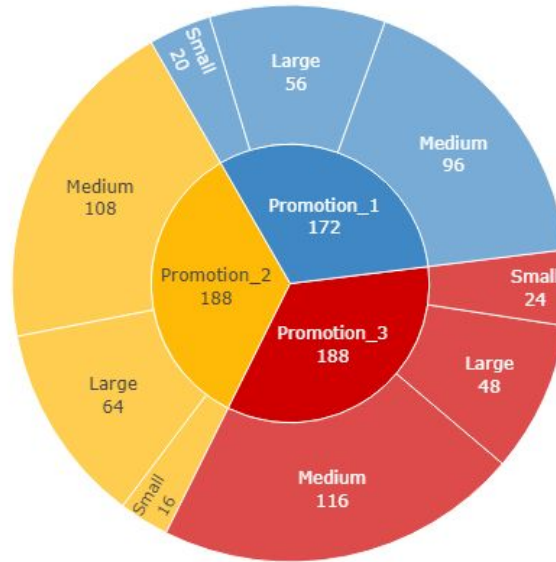
Promotion_1 held the maximum earnings by 99.7 thousand dollars and highest mean by 58.1 thousand dollars, yet Promotion_3 accounted for the greatest total earnings due to its wider implementation across markets with mean 55.4 thousand dollars

Market Size Distribution



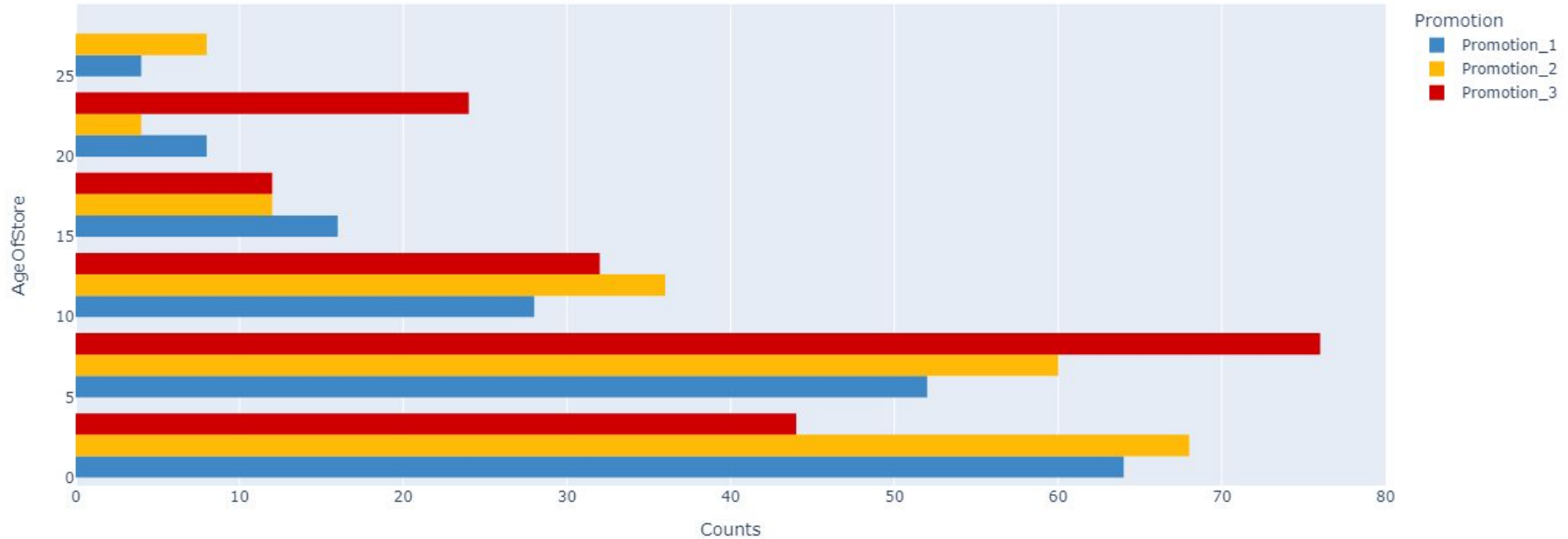
Total 548 markets implemented the promotions for four weeks

Market Size Distribution in Different Promotions



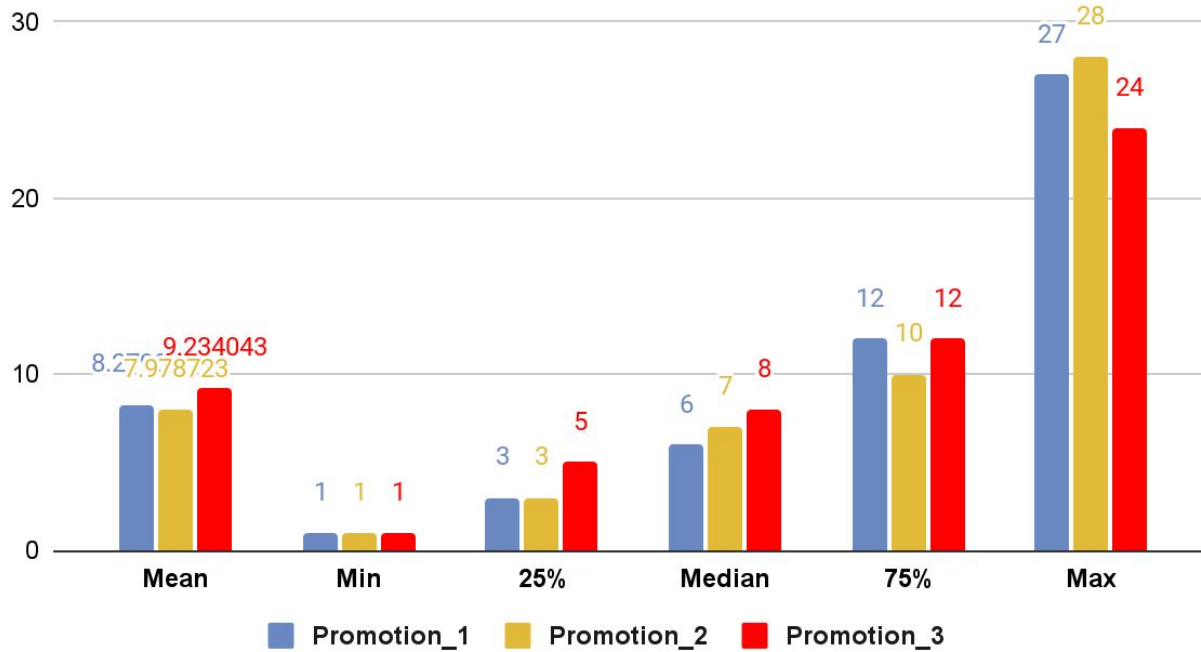
The distribution of market size among each promotion appears to be quite similar, particularly between Promotion_3 and Promotion_2 with medium size market being the most preferred. This suggests that the promotions are being conducted in a relatively balanced manner across the different market sizes.

Age Of Store in Different Promotions



A significant portion of markets have an age of store ranging from 0-4 years for Promotion_1 and Promotion_2 and 5 to 9 years for Promotion_3

Age of Store



The statistical analysis discloses that around 75% of the markets implementing promotions have a store age below 10-12 years, with an average age of approximately 8-9 years

A/B Testing

A/B Testing

A/B testing has two hypotheses concepts:

- **Null Hypothesis (H0)**
The statement that there is no effect or no significant difference between variables
- **Alternative Hypothesis (H1)**
The statement that contradicts the null hypothesis

A/B Testing

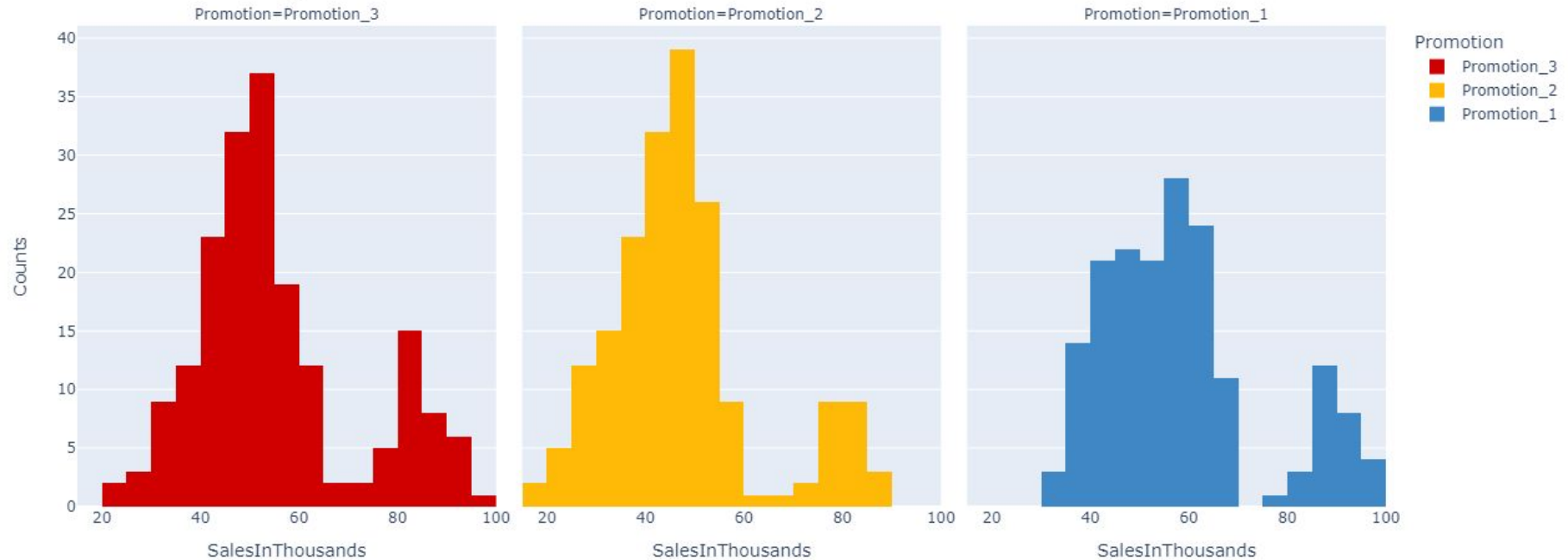
Two type of values:

- **T-value**
The larger value, the higher degree of difference of variables
- **P-value**
The smaller value, the more statistically difference of variables

The significant level (α) we used is 0.05. Subsequently,

- **P-value $\leq \alpha$** , the null hypothesis rejected and conclude that there is evidence to support the alternative hypothesis (significant difference)
- **P-value $> \alpha$** , the null hypothesis failed to reject, meaning that there is not enough evidence to support the alternative hypothesis (no significant difference)

Sales Distribution by Different Promotions



Guided by the histograms, all types of promotions are the combination of two distinct groups of data with double-peaked distribution which shows bimodal distribution

Shapiro-Wilk Test

The Shapiro-Wilk test is a statistical test used to check if the distribution of sales by each promotions is normally distributed or not

If the p-value from the test is below a certain significance level (commonly 0.05), then the null hypothesis is rejected, indicating that the data does not follow a normal distribution

Shapiro-Wilk Test

Promotion_1

Shapiro-Wilk Test:
0.9152998328208923

P-value:
1.9772498305314912e-08

Data is not normally distributed

Promotion_2

Shapiro-Wilk Test:
0.9145088195800781

P-value:
5.456247009760773e-09

Data is not normally distributed

Promotion_3

Shapiro-Wilk Test:
0.9207685589790344

P-value:
1.499518376135711e-08

Data is not normally distributed

For this reason, common t-test can't be applied,
non-parametric tests need to be utilized, such as **Mann-Whitney U test**

Mann-Whitney U Test

Mann-Whitney U test is a statistical test that compares distributions of two types of promotions, whether it is a significant difference or not without assuming normality (non-normally distributed, unequal variances)

Mann-Whitney U Test

Promotion_1 vs Promotion_2

Mann-Whitney U statistic:
22957.5

P-value:
5.845935246838518e-12

Reject null hypothesis:
Groups are different

Promotion_2 vs Promotion_3

Mann-Whitney U statistic:
12093.0

P-value:
1.1970084441651803e-07

Reject null hypothesis:
Groups are different

Promotion_1 vs Promotion_3

Mann-Whitney U statistic:
18247.0

P-value:
0.035084095693231204

Fail to reject null hypothesis:
**No significant difference between
groups**

Drawing from the results, Promotion_2 are significantly different with other promotion types,
meanwhile Promotion_1 and Promotion_3 have no significant difference

Conclusion

Which promotion has the greatest effect on sales?

Taking the sales distribution into account where Promotion_2 sales are the lowest even with more market distribution employed

Promotion_3 has slightly higher total sales from Promotion_1 in four weeks considered its market distribution also wider than Promotion_1

As a result, **Promotion_1** or **Promotion_3** with no significance difference has the greatest effect on sales and can be considered as the best promotion to get implemented

Recommendation

We could look out to other details from both promotions such as cost production for Promotion_1 and Promotion_3 before choosing one of the promotions

References



Linkedin



Github



Slides