Advanced Assignment: Spreadsheet & Statistics

1. Business Understanding - Advanced

Background

- Fast-food chain plans to add a new item to its menu.
- The company is still undecided between three possible marketing campaigns for promoting the new product.
- In order to determine which promotion has the greatest effect on sales, the new item is introduced at locations in several randomly selected markets.

1. Business Understanding - Advanced

Core Business Problem

- Company wants to know which among 3 marketing campaigns yield the best sales.
- Company wants to know whether market size has effect on sales.

1. Business Understanding - Advanced

How data provided could help answer business problem

The dataset provides informations about sales performance of each marketing campaigns so that I can run statistical test to infer the conclusion into real population.

1. Business Understanding - Advanced

Statistics that can answer business problems

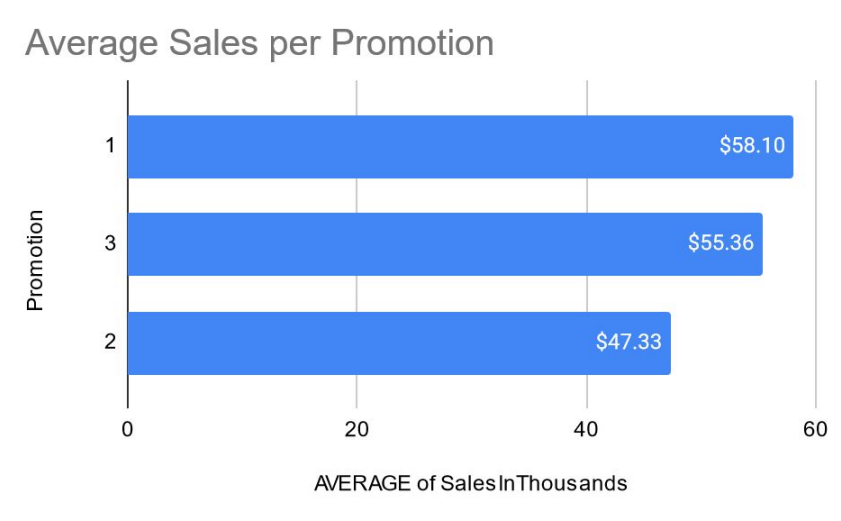
- After cleaning the data, exploratory data analysis are the first thing I can do.
- To generalize insight from sample to population, I need to run hypothesis test.

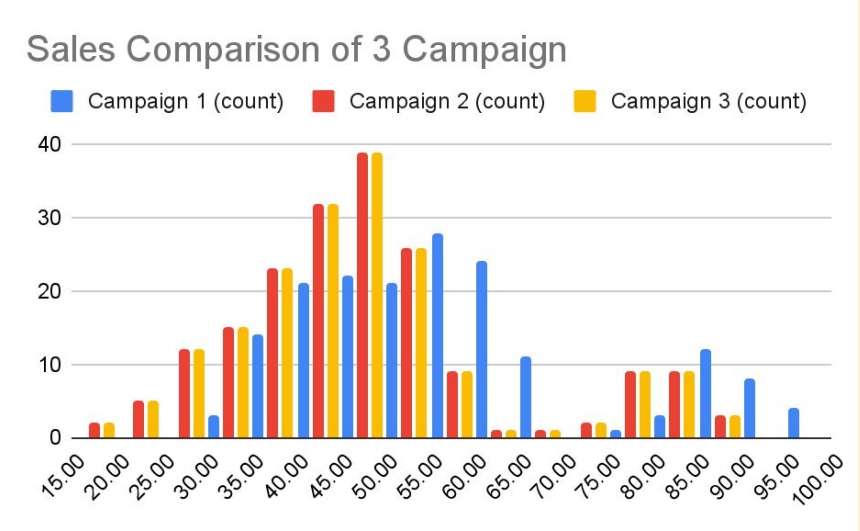
For example:

Correlation study or T-test

2. Exploratory Data Analysis

Marketing Campaign Performance





INSIGHTS:

- Marketing Campaign 1 have better average sales than other.
- All 3 marketing campaign have double peak in their distribution, indicating there are other factor that influences sales other than marketing campaign.

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2. Exploratory Data Analysis

Character of Store Based on Market Size

	Small	Medium	Large
Number of Unique Store	15	80	42
Average age	10.8	8.8	7.1
Average Sales	$57,409	$43,985	$70,116
Sales Sum	$3408.39	$14000.06	$11779.61

INSIGHTS:

- Medium market size store is the most represented sample and the small size store is the least represented.
- Larger market size store tend to have lesser average age.
- In the sample, medium market size stores generate the most sales, although the average sales per store is the lowest.

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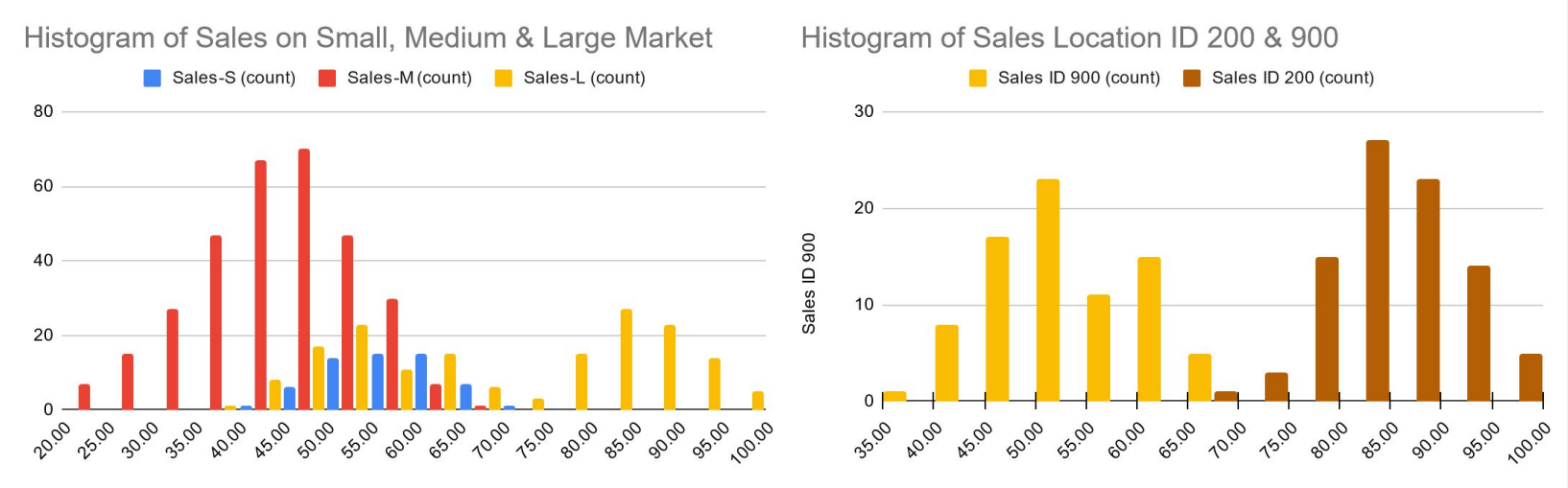
2. Exploratory Data Analysis

Character of Store Based on Market Size



INSIGHTS:

- Only large market size that have bimodal distribution
- Large market size can be subset into 2 groups based on Location ID. Location ID from 200 to 222 forms the most of the outliers and make better sales than the 900s group.
- I decide not to delete this outliers.

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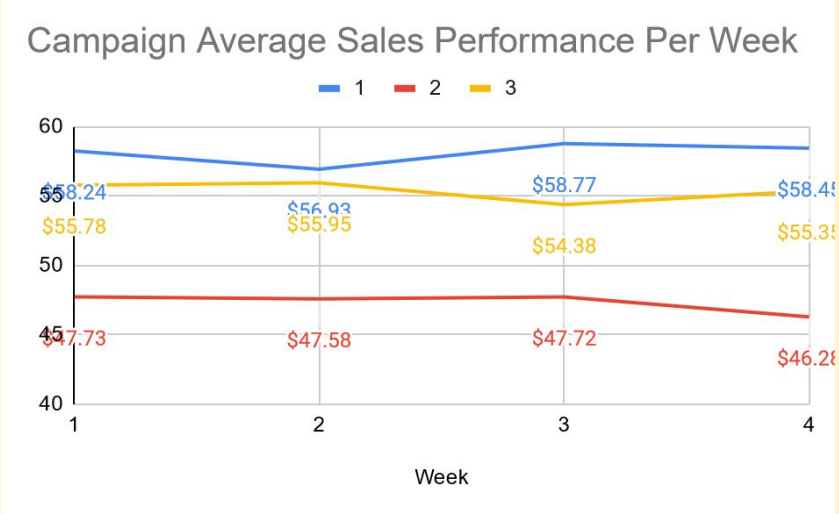
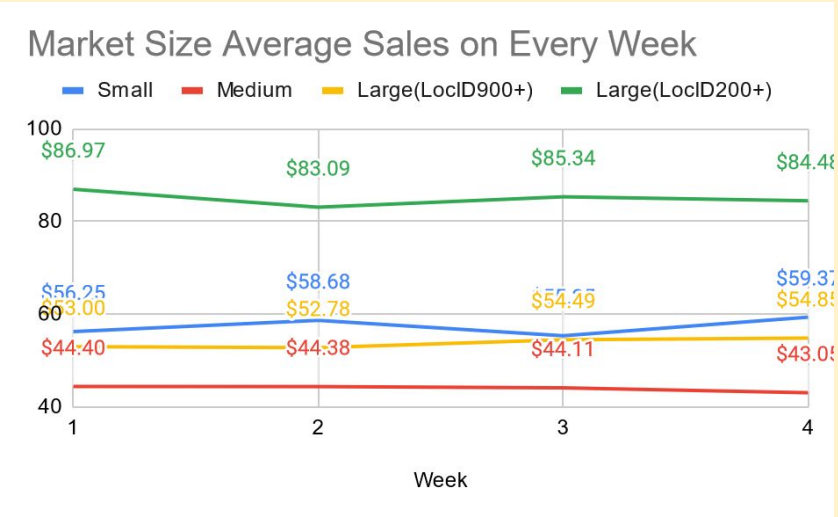
2. Exploratory Data Analysis

Sales Performance Each Week





INSIGHTS:

- Campaign 1 sales outperform other campaign in every week.
- Large market size(loc ID 200+) sales is far better than other in every week

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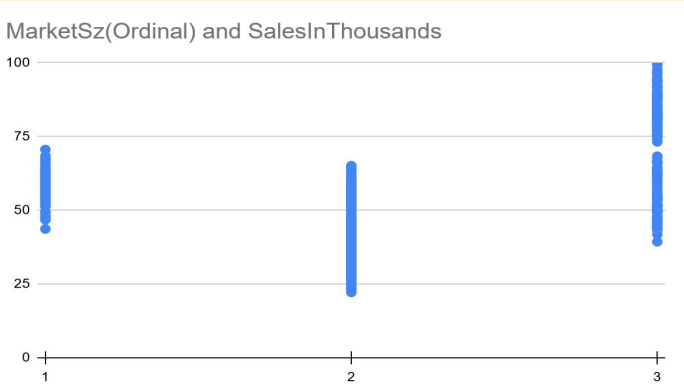
3. Correlation Study

	MarketID	*MarketSz(Ordinal)*	*LocationID*	*AgeOfStore*	*Promotion*	*Week*	*SalesInThousands*
MarketID	*1.00*						
MarketSz(Ordinal)	0.26	1.00					
LocationID	1.00	0.27	1.00				
AgeOfStore	-0.05	-0.17	-0.05	1.00			
Promotion	-0.05	-0.06	-0.05	0.06	1.00		
Week	0.00	0.00	0.00	0.00	0.00	1.00	
SalesInThousands	-0.19	0.45	-0.19	-0.03	-0.06	-0.01	1.00



t-critical	11.86091683
p-value	0

INSIGHTS:

- H0: there is no linear correlation between market size and sales (ρ=0)
- H1: there is linear correlation between market size and sales (ρ≠0)
- Conclusion: reject H0, as market size get bigger, sales also increased, with moderate positive correlation. However, this conclusion is generated while there is still Location ID 200s in the dataset

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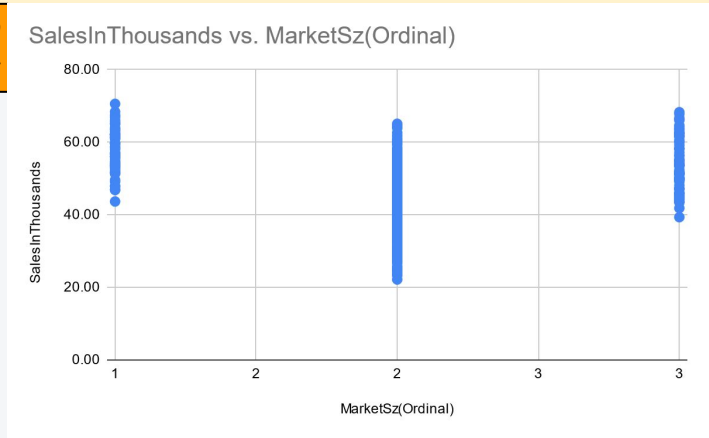
3. Correlation Study

	MarketID	*MarketSz(Ordinal)*	*LocationID*	*AgeOfStore*	*Promotion*	*Week*	*SalesInThousands*
MarketID	1.00						
MarketSz(Ordinal)	0.67	1.00					
LocationID	1.00	0.67	1.00				
AgeOfStore	-0.10	-0.16	-0.10	1.00			
Promotion	-0.04	-0.10	-0.04	0.07	1.00		
Week	0.00	0.00	0.00	0.00	0.00	1.00	
SalesInThousands	0.30	-0.04	0.30	0.10	-0.14	-0.01	1.00



INSIGHTS:

- If I exclude Location ID 200s from the analysis, there is almost no linear correlation between market size and sales.

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3. T-Test on Sales Per Campaign

	Promo 1	*Promo 2*	*alpha*
Mean	51.96465278	42.976875	0.01667*
Observations	144	160	
P(T<=t) two-tail	0		
	Promo 1	*Promo 3*	
Mean	51.96465278	48.36407895	
Observations	144	152	
P(T<=t) two-tail	0.0009		
	Promo 2	*Promo 3*	
Mean	42.976875	48.36407895	
Observations	160	152	
P(T<=t) two-tail	0.0000002		

*alpha=0.01667 because of Bonferroni correction

INSIGHTS:

- Marketing campaign 1 better than other 2 campaign. 2nd best is campaign 3. All of the differences is statistically significant

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3. T-Test on Market Size Effect on Sales

	Small	*Medium*	*alpha*
Mean	57.40933333	43.98534375	0.0083*
Observations	60	320	
P(T<=t) two-tail	0		

	Medium	*Large(Loc900)*	*alpha*
Mean	43.98534375	53.77625	0.0083*
Observations	320	80	
P(T<=t) two-tail	0		

	Small	*Large(Loc900)*
Mean	57.40933333	53.77625
Observations	60	80
P(T<=t) two-tail	0.0023	

	Medium	*Large(Loc200)*
Mean	43.98534375	84.97170455
Observations	320	88
P(T<=t) two-tail	0	

	Small	*Large(Loc200)*
Mean	57.40933333	84.97170455
Observations	60	88
P(T<=t) two-tail	0	

	Large(Loc900)	*Large(Loc200)*
Mean	53.77625	84.97170455
Observations	80	88
P(T<=t) two-tail	0	

*alpha=0.0083 because of Bonferroni correction

INSIGHTS:

- Market size Large Location ID 200+ has the best sales with huge difference, followed by Small, Large Location ID 900+ and Medium. All the differences is statistically significant.

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4. Final Conclusion and Recommendation

- **Marketing campaign 1 yields the best sales**, however, the difference is small with campaign 3. Need to discuss what defines sizable effects and need to compare with cost to perform each marketing campaign.
- Market Size has different impact on Sales, **the rank is Large Location ID 200 > Small > Large Location ID 900 > Medium**.
- Company can **explore other characteristic** that determine the sales, especially on location ID 200.
- If the sampling method used by the company is cluster sampling, **it is better to do simple random sampling or stratified sampling** based on market size next time.

Thank You!