Project: AB Testing for the Success of a New Product

Summary: In this project, I conducted a market test for a coffee chain with a new menu. The project seeks to analyze whether the new menu can drive enough sales to offset the cost of marketing the new menu. I ran an A/B test and wrote up a recommendation to whether the coffee chain should launch the new menu.

Step 1: Data Preparation

In the first step I prepared the data set for analysis via data wrangling.
For my analyses:

1) I used the weekly gross margin for each store.
2) The test period is from 2016, April 29 to 2016, July 21 and AB Analysis covers the data after 2015 February 6 making it a 76 week-period.
3) I aggregated the data at the weekly level, but it is also possible to do it at the monthly level.

Step 2: Cleaning Up Data

In this step, I cleaned up the data for the subsequent steps. I aggregated the transaction data to the appropriate level and filter on the appropriate data ranges.

Step 3: Creating Treatment and Control Units

In this step, I created the trend and seasonality variables, and used them along with the other control variable(s) to match two control units to each treatment unit. I calculated the number of transactions per store per week to calculate trend and seasonality.

I considered the following variables as control variables: '*Region', 'Monthly Sales', 'Square Feet', 'Trend' and 'Seasonality.'*

I checked the correlation among each potential control variable and performance metric.

After Association Analysis, I decided to include '*region', 'Monthly Sales', 'Trend' and 'Seasonality'* measures as the control variables. Square feet variable does not seem to have a correlation with the target variable that is why I excluded it.'

Below is the results of correlation analysis.

Pearson Correlation Analysis

Full Correlation Matrix

	Sum_Gross.Margin	Trend	Seasonality	Sq_Ft	AvgMonthSales
Sum_Gross.Margin	1.000000	-0.050294	0.081599	-0.019345	0.790358
Trend	-0.050294	1.000000	-0.832676	0.205905	-0.114798
Seasonality	0.081599	-0.832676	1.000000	-0.228481	0.153578
Sq_Ft	-0.019345	0.205905	-0.228481	1.000000	-0.046967
AvgMonthSales	0.790358	-0.114798	0.153578	-0.046967	1.000000

Matrix of Corresponding p-values

	Sum_Gross.Margin	Trend	Seasonality	Sq_Ft	AvgMonthSales
Sum_Gross.Margin		4.2126e-07	2.2204e-16	5.1796e-02	0.0000e+00
Trend	4.2126e-07		0.0000e+00	0.0000e+00	0.0000e+00
Seasonality	2.2204e-16	0.0000e+00		0.0000e+00	0.0000e+00
Sq_Ft	5.1796e-02	0.0000e+00	0.0000e+00		2.3119e-06
AvgMonthSales	0.0000e+00	0.0000e+00	0.0000e+00	2.3119e-06	

I created 2 control stores for each treatment stores based on the **Distance between a Control Unit and Its Assigned Treatment.**

Treatment Store	Control Store 1	Control Store 2
1664	7162	8112
1675	1580	1807
1696	1863	1964
1700	1630	2014
1712	7434	8162
2288	2568	9081
2293	12219	9524
2301	3102	9238
2322	2409	3235
2341	12536	2383

Distance Between a Control Unit and its Assigned Treatment

Control Unit	Assigned Treatment	Distance to Treatment
2568	2288	0.7141
9081	2288	0.2779
12219	2293	0.3486
9524	2293	0.6560
3102	2301	0.3812
9238	2301	0.4346
2409	2322	0.1714
3235	2322	0.4513
12536	2341	0.3980
2383	2341	0.4238

Distance Between a Control Unit and its Assigned Treatment

Control Unit	Assigned Treatment	Distance to Treatment
7162	1664	0.4786
8112	1664	1.0344
1580	1675	0.4563
1807	1675	0.5605
1863	1696	0.4891
1964	1696	0.3124
1630	1700	0.9162
2014	1700	0.8104
7434	1712	0.7933
8162	1712	0.6714

Step 4: Analysis

I conducted A/B analysis to inform my recommendations. Accordingly, the company should roll out the updated menu to all stores. That is because, in both experimental regions, the models have significance level over 90% with the relevant lift rates, respectively.

Furthermore, For the Western regions, the model significance is 99.5% and the lift from the new menu is 37.9% bringing average 526.5 dollars additional gross margin for each store for each week.


AB Test Analysis for Sum_Gross Margin
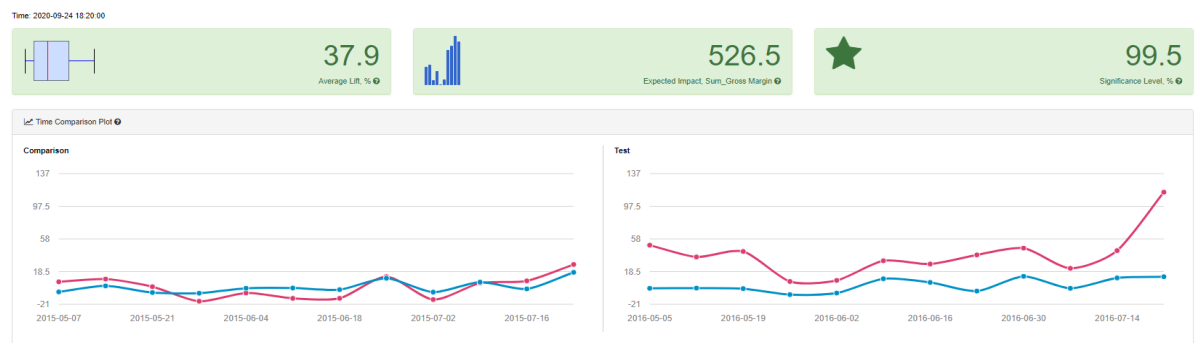
For the Central regions, the model significance is 99.6% and the lift from the new menu is 43.5% bringing average 835.9 dollars additional gross margin for each store for each week.

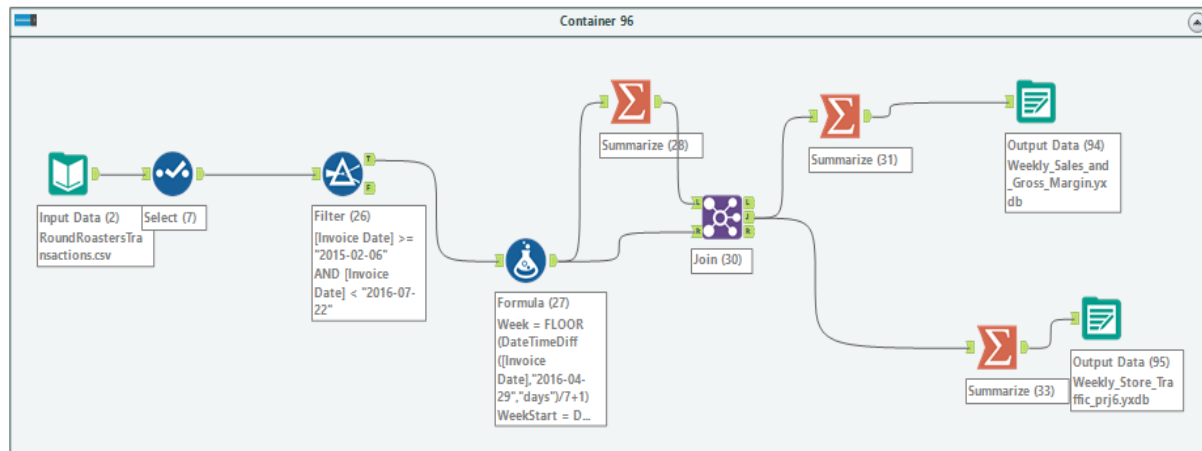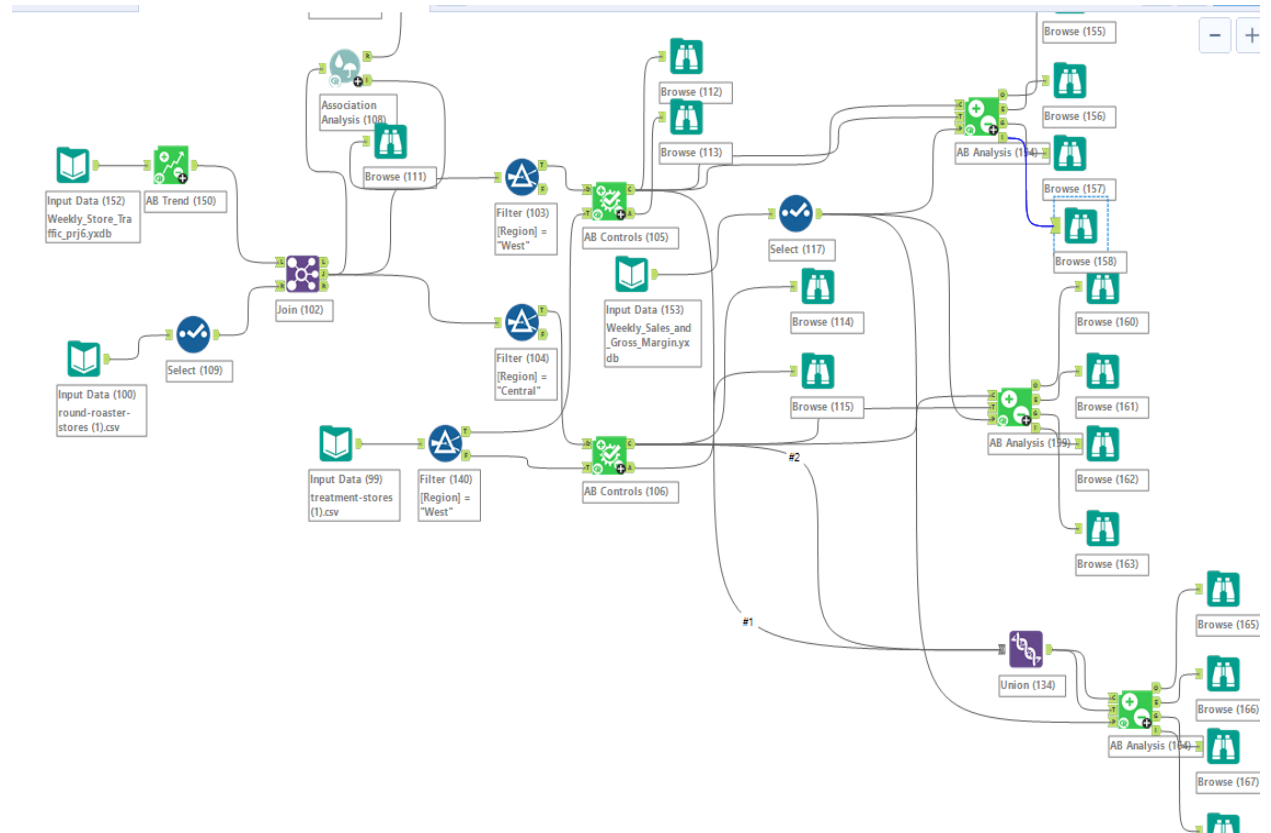AB Test Analysis for Sum_Gross Margin
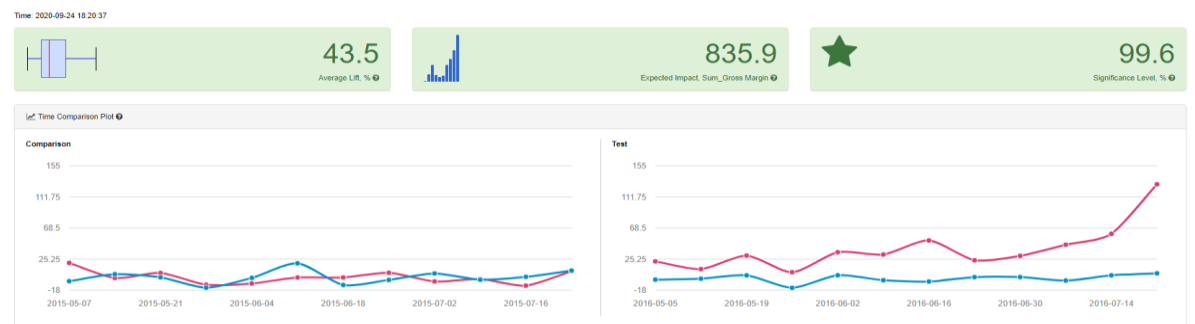
Overall lift is 40.7% with 100% significance, bringing 681.2 dollars additional gross margin - for each store for each week.

AB Test Analysis for Sum_Gross Margin
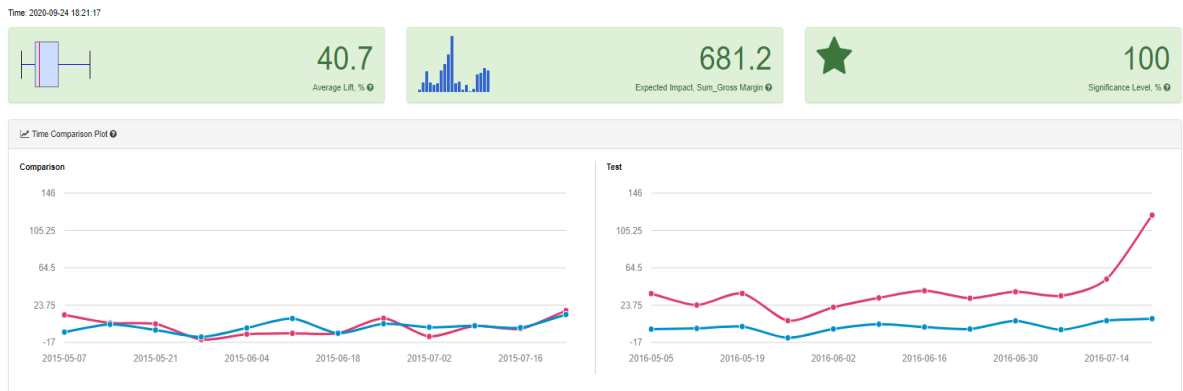
Below are the Alteryx workflows for the data preparation, trend and seasonality calculations, pairs matching and AB analysis.

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