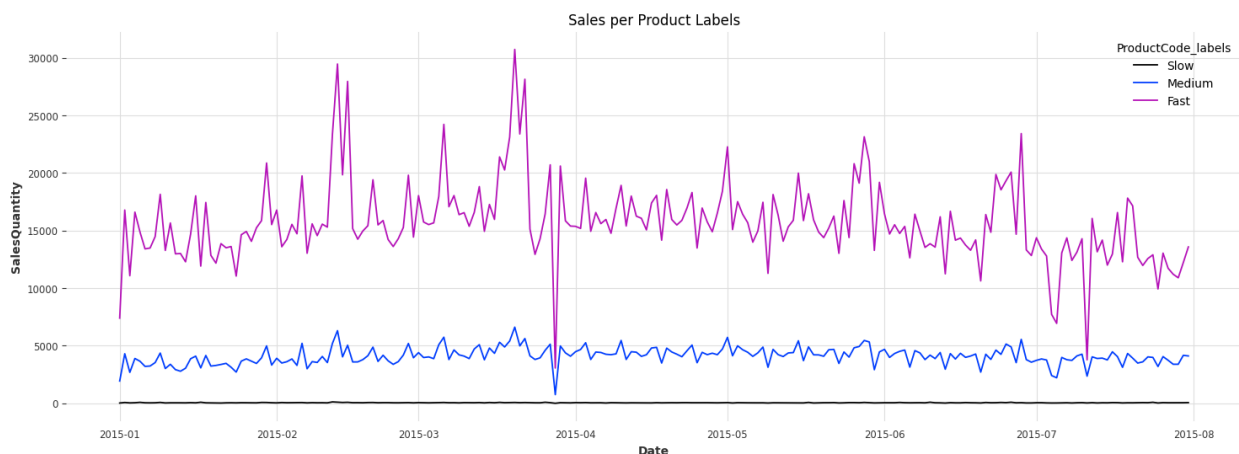


# Invent Analytics I

## Assignment A)

a - What are your criteria for separating Fast, Medium and Slow items? Why?

I categorized the products based on their position in the sales distribution chart. Products performing below the **25th** percentile were labeled as "**Slow**," while those performing above the **75th** percentile were labeled as "**Fast**" The remaining products were assigned the "**Medium**" label.



There are a couple of reasons for this grouping method.

- **Goal-oriented:** Percentiles show the critical levels in the distribution and the relative location of any product compared to others. Since my goal is to create a

hierarchy among products, I can easily see the best and worst-performing products.

- **Interpretable:** Choosing percentiles as grouping criteria is a very simple and interpretable technique. This method does not include intricate formulas that require explanation. It is easy for the clients to understand what I do and help them stay with me.
- **Robust:** Unlike averages, percentiles cannot be easily distorted by one or two extreme values in the dataset. Labels of the products are not primarily impacted by the performance of others. This method gives me confidence in the results of tests that might be subject to change when data is edited/processed.

**b - What are your criteria for separating Fast, Medium and Slow Stores? Why?**

I followed the same method to label the stores. My answer to the first question is also applicable to this one.

**c - Which items experienced the biggest sale increase during promotions?**

After categorizing the products into groups, I computed the average weekly sales per product on days with and without promotions. I observed that all product groups responded positively to the promotions. Notably, the "Fast" products exhibited the most significant reaction, generating an almost 26% increase in sales. The "Slow" products demonstrated a 16.7% increase. However, the "Medium" products responded relatively poorly, with only an 11.4% increase in sales.

	Nonpromotion_avg	Promotion_avg	PrcntChange
Slow Products	1039.654	1213.200	16.693
Medium Products	17852.500	19900.000	11.469
Fast Products	111856.423	140860.200	25.929

**d - Are there stores that have higher promotion reactions?**

I followed the same approach to see the effect of the promotions on the sales from the "Store" perspective. I separately calculated the average weekly sales per store for

promotion days and non-promotion days. “Fast” stores responded comparatively strongly to the promotions generating 25% more sales. The “Medium” group becomes second with a 22.4% increase and the “Slow” stores are the last with a 21.5% increase in sales.

	Nonpromotion_avg	Promotion_avg	PrcntChange
Medium Stores	35268.077	43183.800	22.444
Fast Stores	73537.077	92123.800	25.275
Slow Stores	21943.423	26665.800	21.521

#### e - What is the biggest effect explaining sales change during promotions?

Store type and Product type is important when the effect of a promotion is in question. For example, the sales of fast products increase at least 16.5% on average during promotions.

However the biggest factor that changes the sales is the product-store group pairs. When fast products are sold at fast stores, the promotion yields the highest returns. This combination increases the sales by 24% on average.

Here is a diagram that shows the percentage change in average sales per pair.

	Product_label	Store_label	NonPromo_SalesMean	Promo_SalesMean	PercntChange
8	Fast	Fast	3.377450	4.190281	24.066422
7	Fast	Medium	2.577881	3.102875	20.365332
6	Fast	Slow	2.224626	2.593101	16.563479
2	Slow	Fast	0.465963	0.538640	15.596968
4	Medium	Medium	0.870654	0.952703	9.423751
5	Medium	Fast	1.035676	1.131882	9.289208
1	Slow	Medium	0.418338	0.453633	8.436986
0	Slow	Slow	0.399069	0.426434	6.857232
3	Medium	Slow	0.816420	0.848230	3.896228

**f - Is there any significant difference between promotion impacts of the Fast versus Slow items?**

Here are the steps I followed to answer this question:

- Split the data for each individual product in the “Fast” and “Slow” product groups.
- Calculated the weekly averages from the promotion days and non-promotion days.
- Calculated the percentage change for each product to analyze the impact of promotion.
- Finally, conducted an independent student’s t-test to check if the changes are statistically significant.

For products - the p-value generated by the student’s t-test is **0.032**, rejecting the null hypothesis since it is smaller than the critical value (**0.05**). In other words, **Yes, there is a significant difference between promotion impacts of the Fast versus Slow items.**

**g - Is there any significant difference between promotion impacts of the Fast versus Slow stores?**

I followed the same approach for this question.

For Stores - the p-value generated by the student’s t-test is **0.027**, rejecting the null hypothesis since it is smaller than the critical value (**0.05**). In other words, **Yes, there is a significant difference between promotion impacts of the Fast versus Slow stores.**