INSTACART

CASE STUDY

Business Problem

Instacart, a grocery ordering and delivery app, aims to make it easy to do shopping online with the touch of a button. The Instacart stakeholders want to uncover more information about their sales patterns. They are most interested in the variety of customers in their database along with their purchasing behaviors in order to target the right customer profiles with appropriate marketing strategies. Understanding the different mix of your customers is the key to any successful business.

The business questions we are trying to answer are:

- What are the days and times with the most orders in order to schedule ads at times when there are fewer orders?
- Are there particular times of the day when people spend the most money, as this might inform the type of products they advertise at these times.
- Introduce simpler price range groupings to help direct the efforts of marketing and sales.
- Are there certain types of products that are more popular than others?
- What are the different customer segments? How do their ordering behaviors differ from each other?
  - For example: What's the distribution among users in regards to their brand loyalty? Are there differences in ordering habits based on a customer's loyalty status?

Data Overview

The data is a public dataset that was released by Instacart in 2017. It is anonymized and contains a sample of over 3 million grocery orders from more than 200,000 Instacart users. Accessed from www.instacart.com/datasets/grocery-shopping-2017 via Kaggle. A set of fabricated customer dataset (for analysis purposes) can be downloaded **here**.

Tools

- Python, Jupyter Notebook, Tableau
- Python libraries: Pandas, NumPy, Matplotlib, Seaborn, SciPy

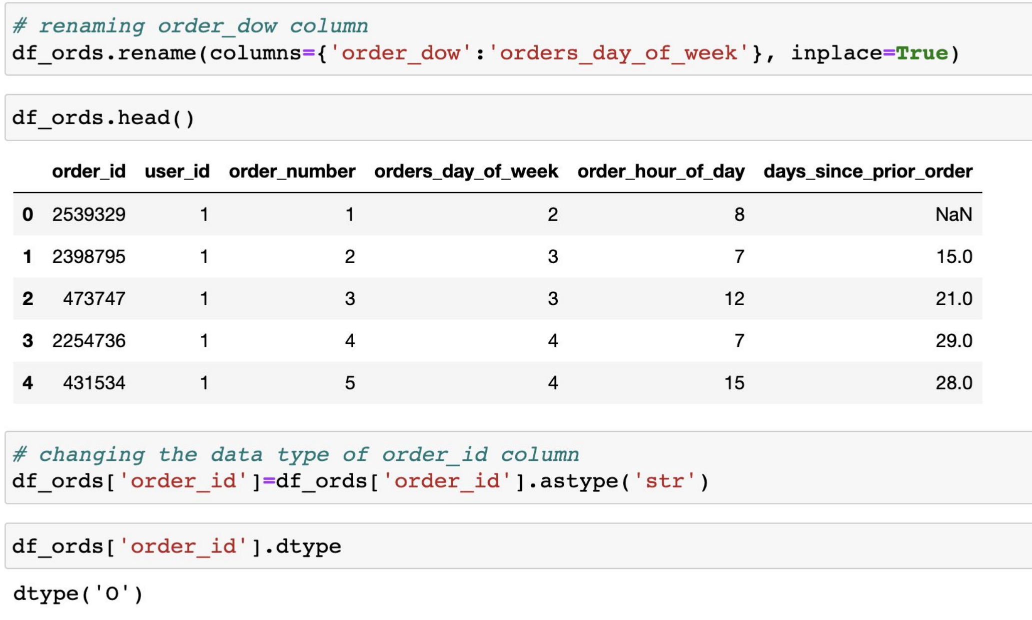
Analytical Methods

Data cleaning and wrangling
Data merging
Grouping data
Visualization
Excel reporting

Data consistency checks
Deriving variables
Aggregating data
Population flows

1. Cleaning and wrangling

- Wrangled and cleaned 5 data sets (orders, products, orders_products_prior, customers, departments) in python using Jupyter Notebook.
- Applied below wrangling procedures to every data set:
  - Dropping columns
  - Renaming columns
  - Changing data types
  - Transposing data



```
# renaming order_dow column
df_ords.rename(columns={'order_dow':'orders_day_of_week'}, inplace=True)
```

```
df_ords.head()
```

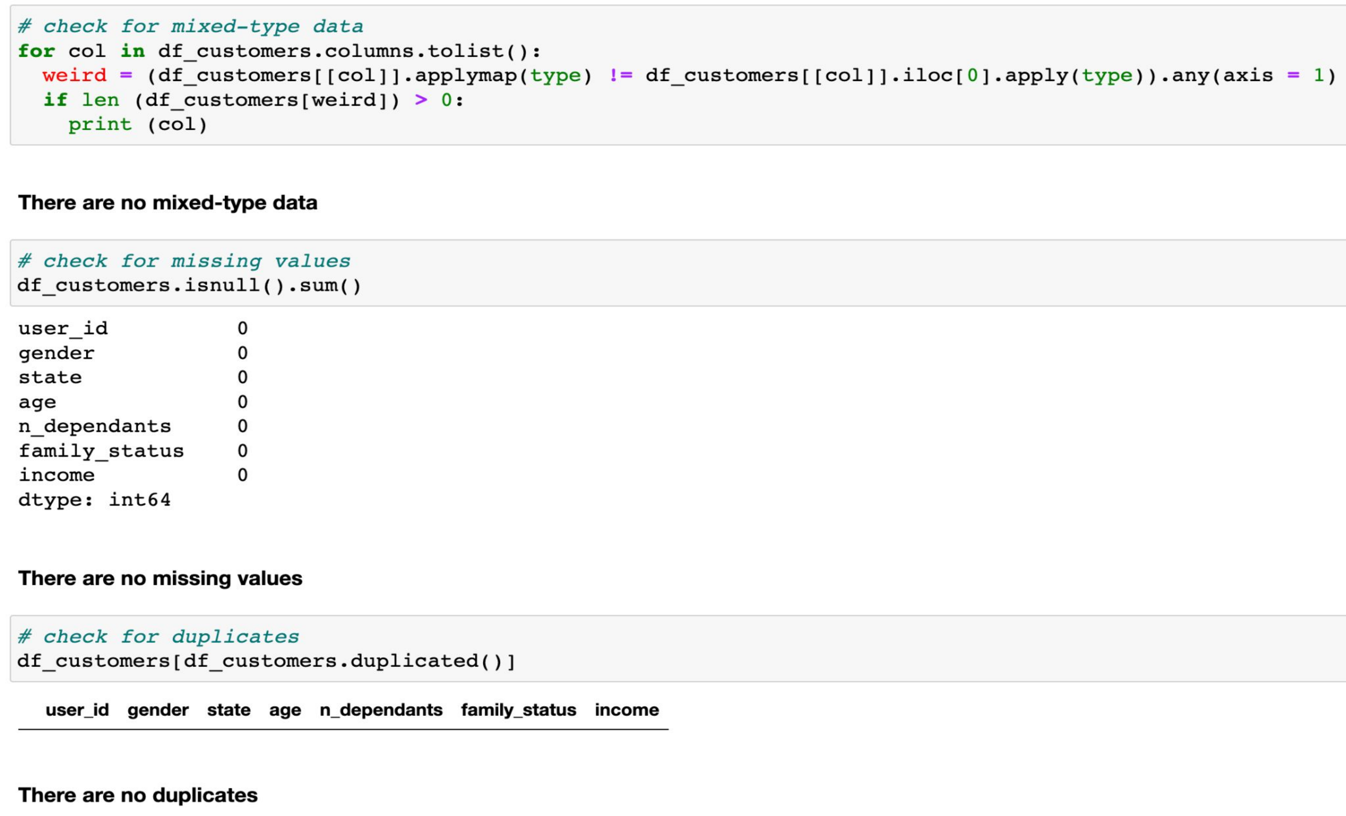
	order_id	user_id	order_number	orders_day_of_week	order_hour_of_day	days_since_prior_order
0	2539329	1	1	2	8	NaN
1	2398795	1	2	3	7	15.0
2	473747	1	3	3	12	21.0
3	2254736	1	4	4	7	29.0
4	431534	1	5	4	15	28.0

```
# changing the data type of order_id column
df_ords['order_id']=df_ords['order_id'].astype('str')
```

```
df_ords['order_id'].dtype
```

```
dtype('O')
```

- Found and addressed below consistency checks in every data set:
    - Mixed-type data
    - Missing values
    - Duplicates



```
# check for mixed-type data
for col in df_customers.columns.tolist():
  weird = (df_customers[[col]].applymap(type) != df_customers[[col]].iloc[0].apply(type)).any(axis = 1)
  if len (df_customers[weird]) > 0:
    print (col)
```

There are no mixed-type data

```
# check for missing values
df_customers.isnull().sum()
```

```
user_id          0
gender           0
state            0
age              0
n_dependants     0
family_status    0
income           0
dtype: int64
```

There are no missing values

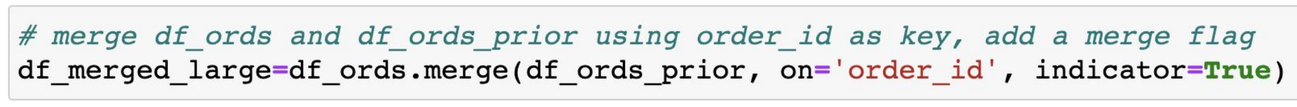
```
# check for duplicates
df_customers[df_customers.duplicated()]
```

	user_id	gender	state	age	n_dependants	family_status	income

There are no duplicates

2. Merging

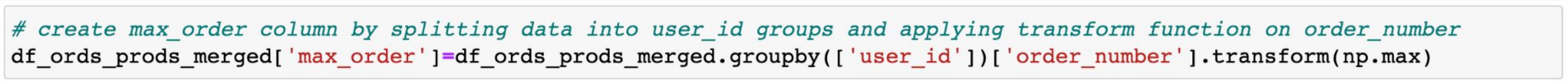
- Data sets were merged into a unified version of 30M+ records.
- Exported the final dataframe to pkl format for faster import and export as well as a high compression rate.



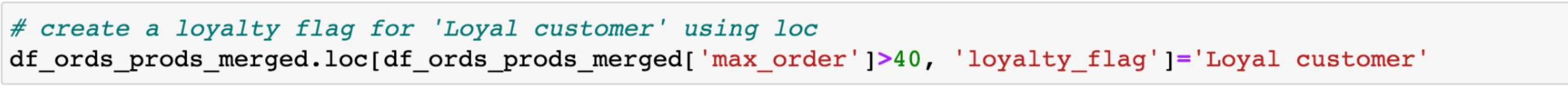
```
# merge df_ords and df_ords_prior using order_id as key, add a merge flag
df_merged_large=df_ords.merge(df_ords_prior, on='order_id', indicator=True)
```

3. Deriving variables

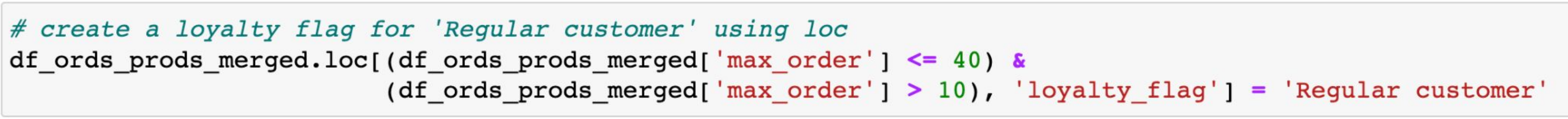
- Derived new variables using if-statements and for-loops by grouping and aggregating data.
- For example, created a loyalty flag for customers using below steps:
  - Apply transform() function, which will create a new column containing the maximum frequency of the number of orders.
  - Apply loc() function which will create a second column containing a flag designating whether a customer is loyal or not.
  - Criteria was defined by the number of orders per customer: over 40, less than 10, or in between.



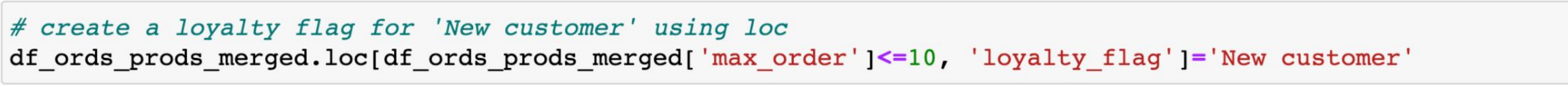
```
# create max_order column by splitting data into user_id groups and applying transform function on order_number
df_ords_prods_merged['max_order']=df_ords_prods_merged.groupby(['user_id'])['order_number'].transform(np.max)
```



```
# create a loyalty flag for 'Loyal customer' using loc
df_ords_prods_merged.loc[df_ords_prods_merged['max_order']>40, 'loyalty_flag']='Loyal customer'
```

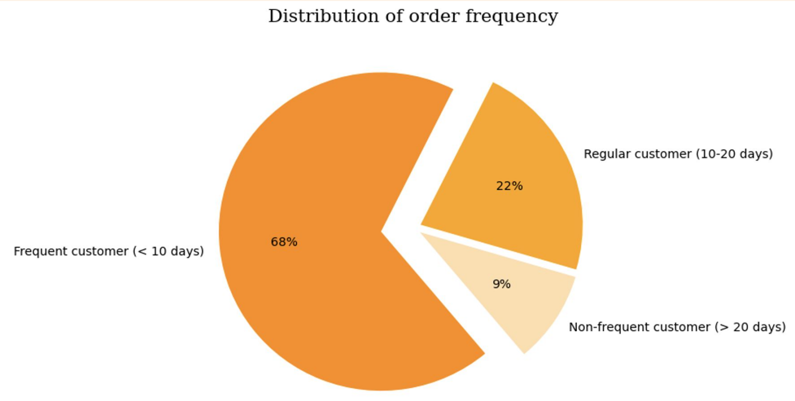


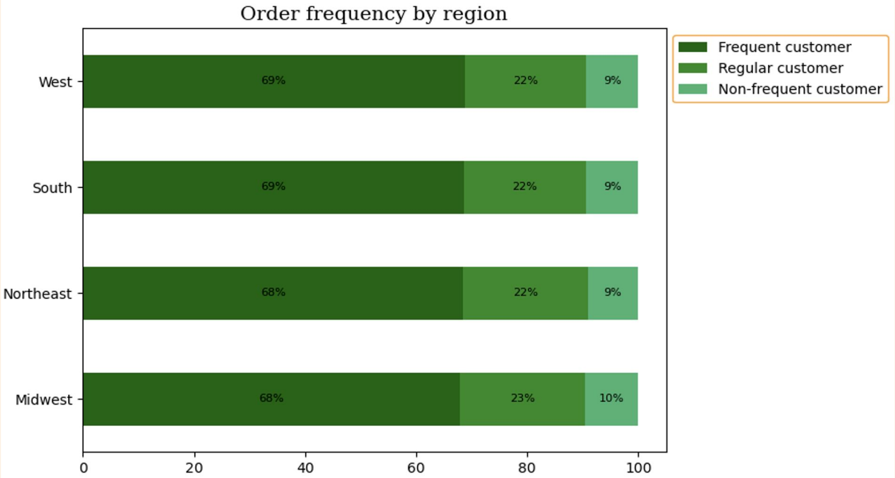
```
# create a loyalty flag for 'Regular customer' using loc
df_ords_prods_merged.loc[(df_ords_prods_merged['max_order'] <= 40) &
                         (df_ords_prods_merged['max_order'] > 10), 'loyalty_flag'] = 'Regular customer'
```



```
# create a loyalty flag for 'New customer' using loc
df_ords_prods_merged.loc[df_ords_prods_merged['max_order']<=10, 'loyalty_flag']='New customer'
```

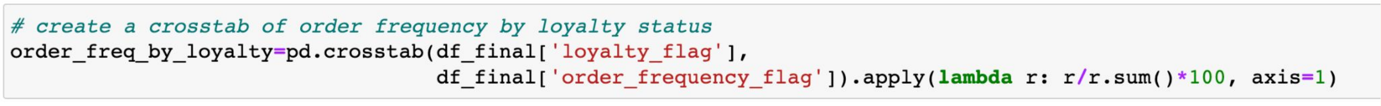
- Much of the analysis revolved around identifying trends and patterns by:
    - first showing overall distribution of newly derived variables such as loyalty status, ordering frequency, and price range of products
    - and second, comparing and contrasting distribution of these variables with other characteristics of the data set, like region, family status, etc.





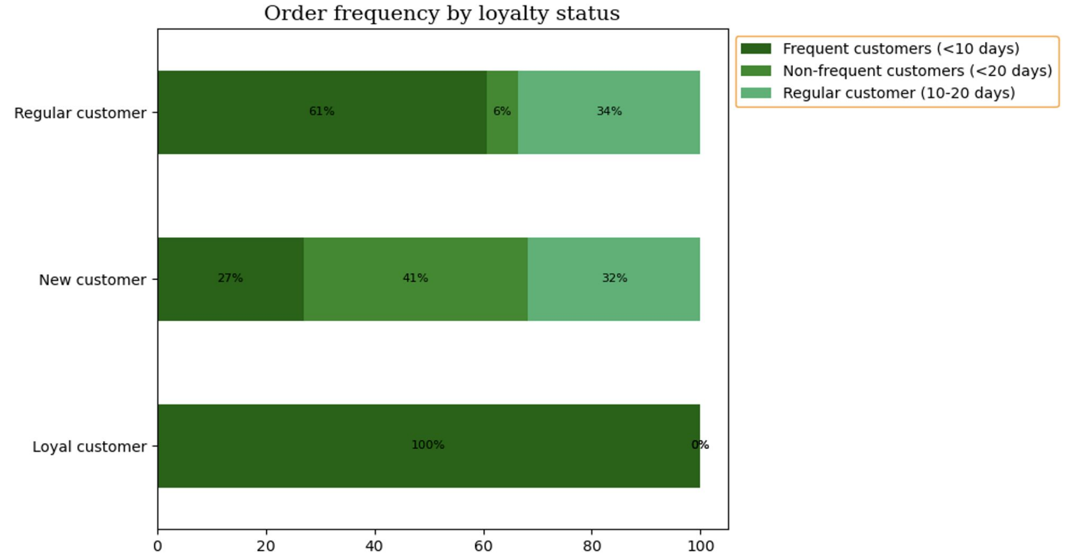
4. Crosstabs

- Created crosstabs to help build customized data frames aiding in analysis.
- For example, created a crosstab between loyalty status and frequency of placing orders.

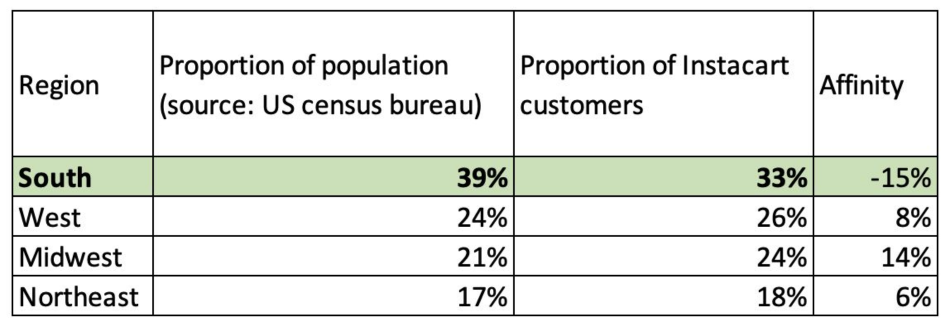


```
# create a crosstab of order frequency by loyalty status
order_freq_by_loyalty=pd.crosstab(df_final['loyalty_flag'],
                                  df_final['order_frequency_flag']).apply(lambda r: r/r.sum()*100, axis=1)
```

- Analyzed values in % to draw comparative analyses and conclusions excluding the size effect of different groups. Also, since the data being evaluated is extensive, expressing in % would present an accurate value.



- Uncovered an interesting insight when it came to ordering habits based on a customer's region.
- 33% of customer base comes from the southern region, making up the largest proportion of Instacart, whereas Northeast has the lowest proportion of customers at 18%.
- However, as per the **US Census Bureau 2022**, South has the highest resident population in US.

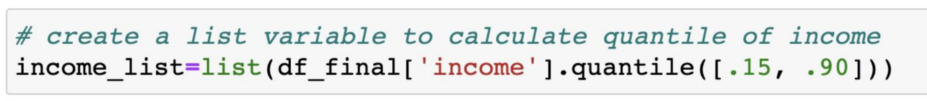


Region	Proportion of population (source: US census bureau)	Proportion of Instacart customers	Affinity
South	**39%**	**33%**	-15%
West	24%	26%	8%
Midwest	21%	24%	14%
Northeast	17%	18%	6%

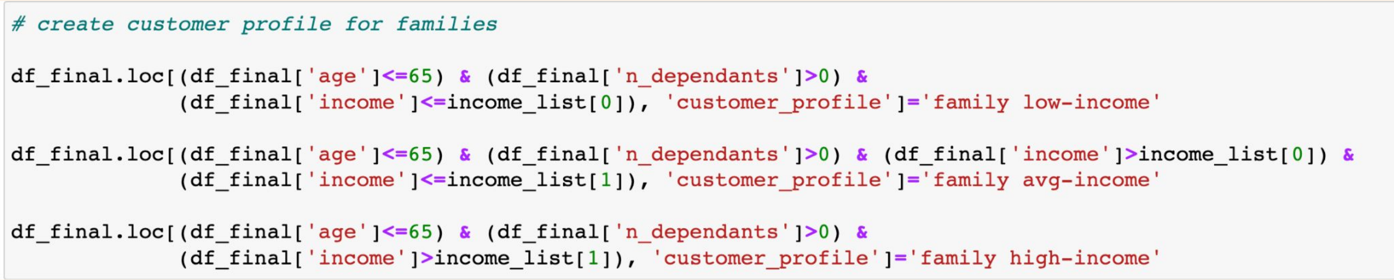
- Although south has the largest customer base of Instacart, this market is not being utilized to the fullest potential owing to its significantly high population, making it the least successful of all regions.
- Comparing the share of customers with the share of population for each US region revealed this important and interesting observation.

5. Customer segmentation

- Created 9 customer profiles based on age, income, number of dependants, and family status by applying loc() function.



```
# create a list variable to calculate quantile of income
income_list=list(df_final['income'].quantile([.15, .90]))
```



```
# create customer profile for families

df_final.loc[(df_final['age']<=65) & (df_final['n_dependants']>0) &
             (df_final['income']<=income_list[0]), 'customer_profile']='family low-income'

df_final.loc[(df_final['age']<=65) & (df_final['n_dependants']>0) & (df_final['income']>income_list[0]) &
             (df_final['income']<=income_list[1]), 'customer_profile']='family avg-income'

df_final.loc[(df_final['age']<=65) & (df_final['n_dependants']>0) &
             (df_final['income']>income_list[1]), 'customer_profile']='family high-income'
```

Code example to create customer profile for families

Insights & Recommendations

- Weekend (friday, saturday, sunday) are the busiest days and the hours from morning to afternoon (9-15) are the busiest time of the day. Schedule ads during the middle of the week on days such as tuesday, wednesday and after 5 pm up untill 8 in the morning. Create a sense of urgency, from time-sensitive special offers to limited-edition products. For example, provide a lower price for customers to purchase by a specific day (in this case on tuesdays or wednesdays) or include a bonus offer on specific hours (in this case after 5 pm) to entice existing as well as new customers. Offer free shipping for a limited time during weekdays after evening hours as a special promotion. This will help to encourage people that now is the time to make a purchase from your store.

- Customers tend to spend most money starting from late night (after 9 pm) upto early morning (5 am). Advertise more products priced in high-range category. Provide 24/7 customer support for any query the customer has. Offering a live chat or chatbot service will help showcase customers that you're always available for them.

- More than 60% of the products are purchased from mid-range category, priced between $5-$15. Sponsor more high-range products during the hours when customers tend to spend most i.e., from late night to early morning. Offer free shipping for orders over a certain amount, which can prompt customers to add more to their basket in order to gain the benefit, thereby increasing sales.

- Fresh products like organic fruits and vegetables are the most re-ordered items, whereas produce and dairy eggs are the most popular departments. Considering the popularity of organic products, it is recommended to stock more options and varieties when it comes to organic food items (labels such as 'gluten-free', 'clean', 'vegan', etc to name a few). Consider increasing the price of organic food as its consumption has seen a steady growth over the past few years among consumers in general. Customers will pay more for organics as they understand the value in doing so. Introduce and promote organic, green, non-toxic product options among other departments too such as organic wine (alcohol dept), organic skincare, cosmetic, oral care, hair care products (personal care dept), lightly breaded varieties of nuggets, strips and tenders (frozen dept), grass fed meat, organic meat and poultry (meat seafood dept), organic gluten-free breads, cookies (bakery dept) and much more. Recommend popular products to new customers. Aim to optimise aisle positioning that is designed to promote cross-selling and up-selling by placing aisles and products with high popularity and demand near each other. Sell products that are very similar to existing ones, but made healthier with the help of alterations to the products' content. Give away samplers, two-for-one offers and other reward-based incentives for products from low selling departments. Doing so will positively boost sales and revenue.

- More than 60% customers purchase frequently within 10 days, while less than 10% purchase after 20 days. Do marketing through emails, social media, SEO. For example, send emails featuring engaging content or discount to introduce them to your must-have products and tempt them to buy more often. Ensure that the processes of shipping and returning are as simple as possible. This will help to encourage customers to return to you time and time again, turning them into frequent buyers.

- Loyal customers on average order every 5 days, where regular customers order every 11 days and new customers every 18 days. Aim to fully convert this segment of regular and new customers into purchasing more frequently. Introduce loyalty programs, trial memberships to enjoy premium benefits, provide 5% cash-back offer to customers who order through express lane, etc. About 40% of new customers are non-frequent with their purchases. Offer an introductory discount for new customers such as 10% off their first order, free shipping, referral program, well-placed opt-in offers such as prompts that encourage people to sign up for the newsletter, mailing list, or loyalty programs, etc. Another way to increase sales volume for new customers is to provide a genuinely useful follow-up procedure. For example, sending detailed summaries of customer's purchase as well as customer service information, links to relevant products the customer might be interested in, and all sorts of other resources.

- Sales performance in South is relatively poor than the other regions. Prioritize southern market when it comes to marketing and luring customers in order to seize the potential within this customer base. Introduce incentives such as cash back, coupon, promo code, discount offers to draw new customers and impress existing ones.

- The age groups of 18-24 and >75 years have a low customer base. Provide promotional deals and special student discount offers for customers aged 18-24 years. Increase engagement with senior customers by asking appropriate questions, setting up polls, posting relatable and interactive content. Make most of simple opportunities such as maximizing the marketing calendar, for example August 25 is Senior Citizens Day – the perfect time to reach the older audience with flash sales and promotions. Ensure to reach all generations in marketing strategy and modify the message to each audience based on each campaign's relevantly chosen social media platform.

- Customers with low income on average purchase snacks 10% more and beverages 4% more in comparison to other customer profiles. Advertise more products from the snacks and beverages department to low-income groups. Provide freebies such as free trial of premium membership for a couple of days, free samples of the most popular products. This will increase not only the number of customers but also sales.

Final Project Deliverables

- GitHub
- Excel Report

Reflections

This was one of my most favorite and challenging project. It allowed me to apply my analytical skills for exploratory analysis in a large dataset consisting of 30M+ records. Quite a lot when it is your first time trying to handle this massive amount of data! Python is supremely good at doing this job and is incredibly fast. I quickly discovered why Python is known as the Swiss Army knife of the coding world. My favorite part was how quick and easy it was to perform complex operations on data, especially compared to conventional analysis tools like Excel. Not only did I develop my coding skills, but also my research skills in the process. Each time I had a doubt or my code broke, I took to helpful blogs online like Stack Overflow, GeeksforGeeks, among others, where I found solutions to my problems and learned a little extra every time. I enjoyed using Jupyter Notebook, especially how I could write my code in one cell and check the output in the next cell. This made locating and fixing errors in my code a lot easier.