Customer Shopping Behavior Analysis

Business Problem Statement

A leading retail company wants to better understand its customers' shopping behavior in order to improve sales, customer satisfaction, and long-term loyalty. The management team has noticed changes in purchasing patterns across demographics, product categories, and sales channels (online vs. offline). They are particularly interested in uncovering which factors, such as discounts, reviews, seasons, or payment preferences, drive consumer decisions and repeat purchases.

You are tasked with analyzing the company's consumer behavior dataset to answer the following overarching business question:

"How can the company leverage consumer shopping data to identify trends, improve customer engagement, and optimize marketing and product strategies?"

Deliverables

1. **Data Preparation & Modeling (Python):** Clean and transform the raw dataset for analysis.
2. **Data Analysis (SQL):** Organize the data into a structured format, simulate business transactions, and run queries to extract insights on customer segments, loyalty, and purchase drivers.
3. **Visualization & Insights (Power BI):** Build an interactive dashboard that highlights key patterns and trends, enabling stakeholders to make data-driven decisions.
4. **Report and Presentation:** Write a clear project report summarizing your key findings and business recommendations. Prepare a presentation that visually communicates insights and actionable recommendations to stakeholders.
5. **GitHub Repository:** Include all Python scripts, SQL queries, and dashboard files in a well-structured repository.

1.Project Overview

This project analyzes customer shopping behavior using transactional data from 3,900 purchases across various product categories. The goal is to uncover insights into spending patterns, customer segments, product preferences, and subscription behavior to guide strategic business decisions.

2.Dataset Summary

- **Rows**: 3,900
- **Columns**: 18
- **Key Features**:
  - Customer demographics (Age, Gender, Location, Subscription Status)
  - Purchase details (Item Purchased, Category, Purchase Amount, Season, Size, Color)
  - Shopping behavior (Discount Applied, Promo Code Used, Previous Purchases, Frequency of Purchases, Review Rating, Shipping Type)
- **Missing Data**: 37 values in the Review Rating column

3.Exploratory Data Analysis using Python

We began with data preparation and cleaning in Python:

- **Data Loading**: Imported the dataset using pandas.
- **Initial Exploration**: Used **df.info( )** to check structure and **df.describe( )** for summary statistics.

```
1  df.describe(include='all')
✓ 0.0s                                                                    Python
```

	Customer ID	Age	Gender	Item Purchased	Category	Purchase Amount (USD)	Location	Size	Color	Season	Review Rating	Subscription Status	Shipping Type	Discount Applied	Pr
count	3900.000000	3900.000000	3900	3900	3900	3900.000000	3900	3900	3900	3900	3863.000000	3900	3900	3900	
unique	NaN	NaN	2	25	4	NaN	50	4	25	4	NaN	2	6	2	
top	NaN	NaN	Male	Blouse	Clothing	NaN	Montana	M	Olive	Spring	NaN	No	Free Shipping	No	
freq	NaN	NaN	2652	171	1737	NaN	96	1755	177	999	NaN	2847	675	2223	
mean	1950.500000	44.068462	NaN	NaN	NaN	59.764359	NaN	NaN	NaN	NaN	3.750065	NaN	NaN	NaN	
std	1125.977353	15.207589	NaN	NaN	NaN	23.685392	NaN	NaN	NaN	NaN	0.716983	NaN	NaN	NaN	
min	1.000000	18.000000	NaN	NaN	NaN	20.000000	NaN	NaN	NaN	NaN	2.500000	NaN	NaN	NaN	
25%	975.750000	31.000000	NaN	NaN	NaN	39.000000	NaN	NaN	NaN	NaN	3.100000	NaN	NaN	NaN	
50%	1950.500000	44.000000	NaN	NaN	NaN	60.000000	NaN	NaN	NaN	NaN	3.800000	NaN	NaN	NaN	
75%	2925.250000	57.000000	NaN	NaN	NaN	81.000000	NaN	NaN	NaN	NaN	4.400000	NaN	NaN	NaN	
max	3900.000000	70.000000	NaN	NaN	NaN	100.000000	NaN	NaN	NaN	NaN	5.000000	NaN	NaN	NaN	

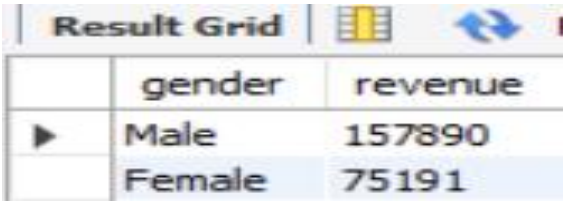
Promo Code Used	Previous Purchases	Payment Method	Frequency of Purchases
3900	3900.000000	3900	3900
2	NaN	6	7
No	NaN	PayPal	Every 3 Months
2223	NaN	677	584
NaN	25.351538	NaN	NaN
NaN	14.447125	NaN	NaN
NaN	1.000000	NaN	NaN
NaN	13.000000	NaN	NaN
NaN	25.000000	NaN	NaN
NaN	38.000000	NaN	NaN
NaN	50.000000	NaN	NaN

- **Missing Data Handling**: Checked for null values and imputed missing values in the **Review Rating** column using the median rating of each product category.
- **Column Standardization**: Renamed columns to **snake case** for better readability and documentation.
- **Feature Engineering**:
  - Created **age_group** column by binning customer ages.
  - Created **purchase_frequency_days** column from purchase data.
- **Data Consistency Check**: Verified if **discount_applied** and **promo_code_used** were redundant; dropped **promo_code_used**.
- **Database Integration**: Connected Python script to MySQL and loaded the cleaned DataFrame into the database for SQL analysis.

4.Data Analysis using SQL (Business Transactions)

We performed structured analysis in MySQL to answer key business questions:

1. **Revenue by Gender**: Compared total revenue generated by male vs. female customers.



2. **High-Spending Discount Users**: Identified customers who used discounts but still spent above the average purchase amount.

	customer_id	purchase_amount
▶	2	64
	3	73
	4	90
	7	85
	9	97
	12	68
	13	72
	16	81
	20	90
	22	62
	24	88
	29	94
	32	79
	33	67
	35	91

3. **Top 5 Products by Rating**: Found products with the highest average review ratings.

	item_purchased text	Average Product Rating numeric
1	Gloves	3.86
2	Sandals	3.84
3	Boots	3.82
4	Hat	3.80
5	Skirt	3.78

4. **Shipping Type Comparison**: Compared average purchase amounts between Standard and Express shipping.

	shipping_type text	round numeric
1	Standard	58.46
2	Express	60.48

5. **Subscribers vs. Non-Subscribers**: Compared average spend and total revenue across subscription status.

	subscription_status text	total_customers bigint	avg_spend numeric	total_revenue numeric
1	Yes	1053	59.49	62645.00
2	No	2847	59.87	170436.00

6. **Discount-Dependent Products**: Identified 5 products with the highest percentage of discounted purchases.

	item_purchased text	discount_rate numeric
1	Hat	50.00
2	Sneakers	49.66
3	Coat	49.07
4	Sweater	48.17
5	Pants	47.37

7. **Customer Segmentation**: Classified customers into New, Returning, and Loyal segments based on purchase history.

	customer_segment text	Number of Customers bigint
1	Loyal	3116
2	New	83
3	Returning	701

8. **Top 3 Products per Category**: Listed the most purchased products within each category.

	item_rank bigint	category text	item_purchased text	total_orders bigint
1	1	Accessories	Jewelry	171
2	2	Accessories	Sunglasses	161
3	3	Accessories	Belt	161
4	1	Clothing	Blouse	171
5	2	Clothing	Pants	171
6	3	Clothing	Shirt	169
7	1	Footwear	Sandals	160
8	2	Footwear	Shoes	150
9	3	Footwear	Sneakers	145
10	1	Outerwear	Jacket	163
11	2	Outerwear	Coat	161

9. **Repeat Buyers & Subscriptions**: Checked whether customers with >5 purchases are more likely to subscribe.

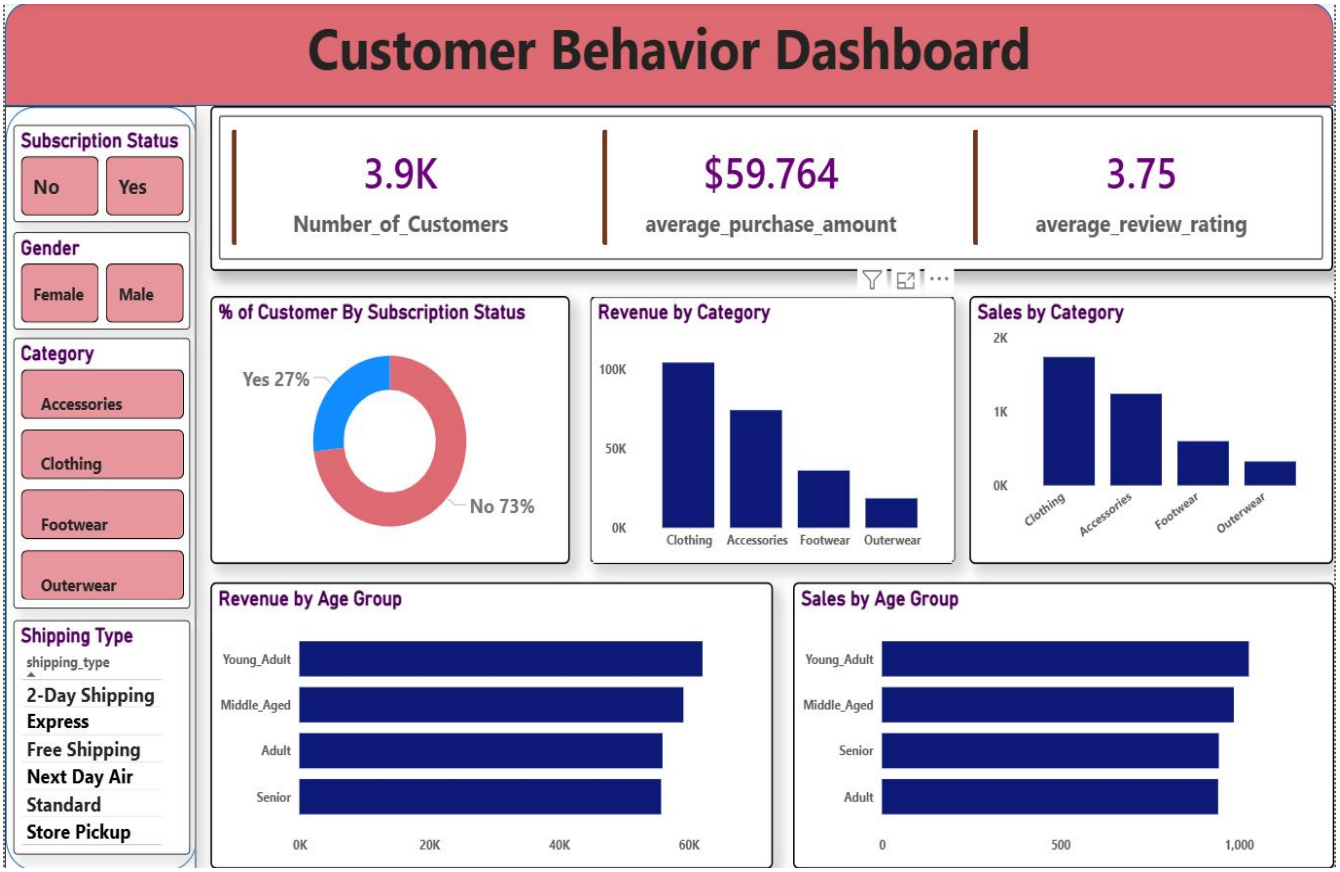
	subscription_status text	repeat_buyers bigint
1	No	2518
2	Yes	958

10. **Revenue by Age Group**: Calculated total revenue contribution of each age group.

	age_group text	total_revenue numeric
1	Young Adult	62143
2	Middle-aged	59197
3	Adult	55978
4	Senior	55763

5.Dashboard in Power BI

Finally, we built an interactive dashboard in Power BI to present insights visually.



6.Recommendations

- **Boost Subscriptions**: Promote exclusive benefits for subscribers.
- **Customer Loyalty Programs**: Reward repeat buyers to move them into the "Loyal" segment.
- **Review Discount Policy**: Balance sales boosts with margin control.
- **Product Positioning**: Highlight top-rated and best-selling products in campaigns.
- **Targeted Marketing**: Focus efforts on high-revenue age groups and express-shipping users.