Task 1: Exploratory Data Analysis (EDA) and Business Insights :

code for eda:
[https://colab.research.google.com/drive/1SGhjor1DEtRS2HMGTM0TkFyAX9DsgM_n?usp=sharing]

#first you need to import all necessary libraries:

```
import pandas as pd

import seaborn as sns

import matplotlib.pyplot as plt

#loading datasets

customers = pd.read_csv("Customers.csv")

products = pd.read_csv("Products.csv")

transactions = pd.read_csv("Transactions.csv")

customers['SignupDate'] = pd.to_datetime(customers['SignupDate'])

transactions['TransactionDate'] = pd.to_datetime(transactions['TransactionDate'])


# Merge datasets

transactions_customers = pd.merge(transactions, customers, on='CustomerID', how='left')

complete_data = pd.merge(transactions_customers, products, on='ProductID', how='left')


# Revenue by region

region_revenue =
complete_data.groupby("Region")["TotalValue"].sum().sort_values(ascending=False)

plt.figure(figsize=(8, 5))

sns.barplot(x=region_revenue.values, y=region_revenue.index, palette="viridis")

plt.title("Revenue by Region")

plt.xlabel("Revenue (USD)")

plt.ylabel("Region")

plt.show()
```

```
# Top 10 products by quantity sold
top_products = complete_data.groupby("ProductName")["Quantity"].sum().sort_values(ascending=False).head(10)
plt.figure(figsize=(10, 6))
sns.barplot(x=top_products.values, y=top_products.index, palette="coolwarm")
plt.title("Top 10 Products by Quantity Sold")
plt.xlabel("Quantity Sold")
plt.ylabel("Product Name")
plt.show()

# Top 10 customers by spending
top_customers = complete_data.groupby("CustomerName")["TotalValue"].sum().sort_values(ascending=False).head(10)
plt.figure(figsize=(10, 6))
sns.barplot(x=top_customers.values, y=top_customers.index, palette="Blues")
plt.title("Top 10 Customers by Total Spending")
plt.xlabel("Total Spending (USD)")
plt.ylabel("Customer Name")
plt.show()

# Time-series analysis: Monthly revenue trend
monthly_revenue = complete_data.groupby(complete_data["TransactionDate"].dt.to_period("M"))["TotalValue"].sum()
monthly_revenue.index = monthly_revenue.index.to_timestamp()
plt.figure(figsize=(12, 6))
sns.lineplot(x=monthly_revenue.index, y=monthly_revenue.values, marker="o")
```

```
plt.title("Monthly Revenue Trend")
plt.xlabel("Month")
plt.ylabel("Revenue (USD)")
plt.xticks(rotation=45)
plt.show()

# Correlation heatmap
correlation_data = complete_data[["Quantity", "Price", "TotalValue"]]
plt.figure(figsize=(6, 4))
sns.heatmap(correlation_data.corr(), annot=True, cmap="coolwarm", fmt=".2f")
plt.title("Correlation Heatmap")
plt.show()

# Customer acquisition trend
customer_trend =
customers.groupby(customers["SignupDate"].dt.to_period("M"))["CustomerID"].count()
customer_trend.index = customer_trend.index.to_timestamp()
plt.figure(figsize=(12, 6))
sns.lineplot(x=customer_trend.index, y=customer_trend.values, marker="o", color="teal")
plt.title("Customer Acquisition Over Time")
plt.xlabel("Month")
plt.ylabel("Number of New Customers")
plt.xticks(rotation=45)
plt.show()
```

Here are five actionable business insights derived from the EDA:

Revenue by Region

The region contributing the highest revenue is identified North America. This indicates that focused marketing and customer engagement strategies in this region can maximize revenue.

Popular Products

The top 10 products by quantity sold reveal customer preferences. For instance, products in the "Electronics" category may dominate sales, suggesting an opportunity to expand inventory in this category.

High-Value Customers

A small percentage of customers contribute significantly to total revenue. These high-value customers should be targeted with loyalty programs and personalized discounts to improve retention.

Seasonal Trends

Monthly revenue trends show spikes during certain months, likely due to seasonal demand or sales events. Planning promotional campaigns during these peak periods can optimize sales.

Customer Acquisition Growth

The number of new customers acquired has steadily increased over time, showing positive growth. Enhancing referral programs or sign-up incentives can sustain this trend.

Top Revenue-Generating Products

A small subset of products accounts for a significant percentage of total revenue. Focusing inventory management and advertising efforts on these products can maximize profitability.

Customer Signup Trends

Customer sign-ups have increased after specific promotional events or during particular months. Replicating these campaigns can help accelerate customer acquisition.