SQL AND PYTHON
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Step 1: Clean Data in SQL (SQLite)

1. Remove Null or Missing Records In DB Browser > Execute SQL, run:

```
DELETE FROM superstore
WHERE "Order ID" IS NULL
  OR "Category" IS NULL
  OR "Sales" IS NULL
  OR "Profit" IS NULL;
```

2. Remove Duplicates (Based on Order ID)
Since SQLite doesn't have ROW_NUMBER(), use this workaround:

```
DELETE FROM superstore
WHERE rowid NOT IN (
   SELECT MIN(rowid)
   FROM superstore
   GROUP BY "Order ID"
);
```

3. Verify Cleaned Table
Check the number of rows a er cleaning:

```
SELECT COUNT(*) FROM superstore;
```

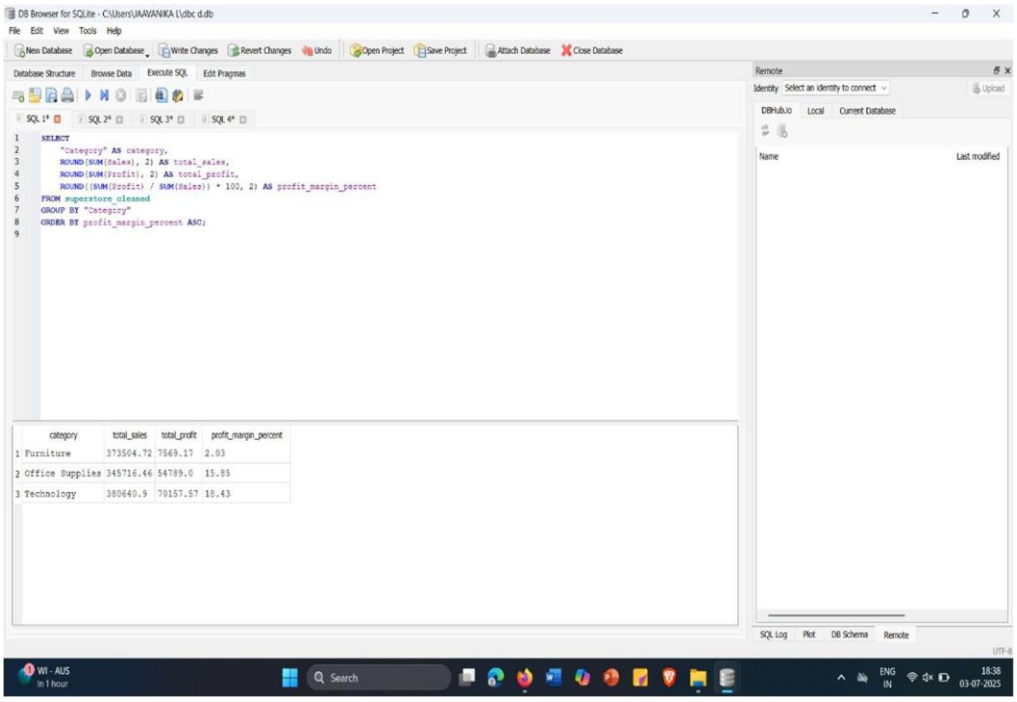
4. Export Cleaned Table (Op onal) You can now:

- Go to File > Export > Table as CSV
- Save as superstore_cleaned.csv
  (You'll use this cleaned CSV in Python and Tableau)

Step 2: SQL Profitability Analysis (Clean Data)

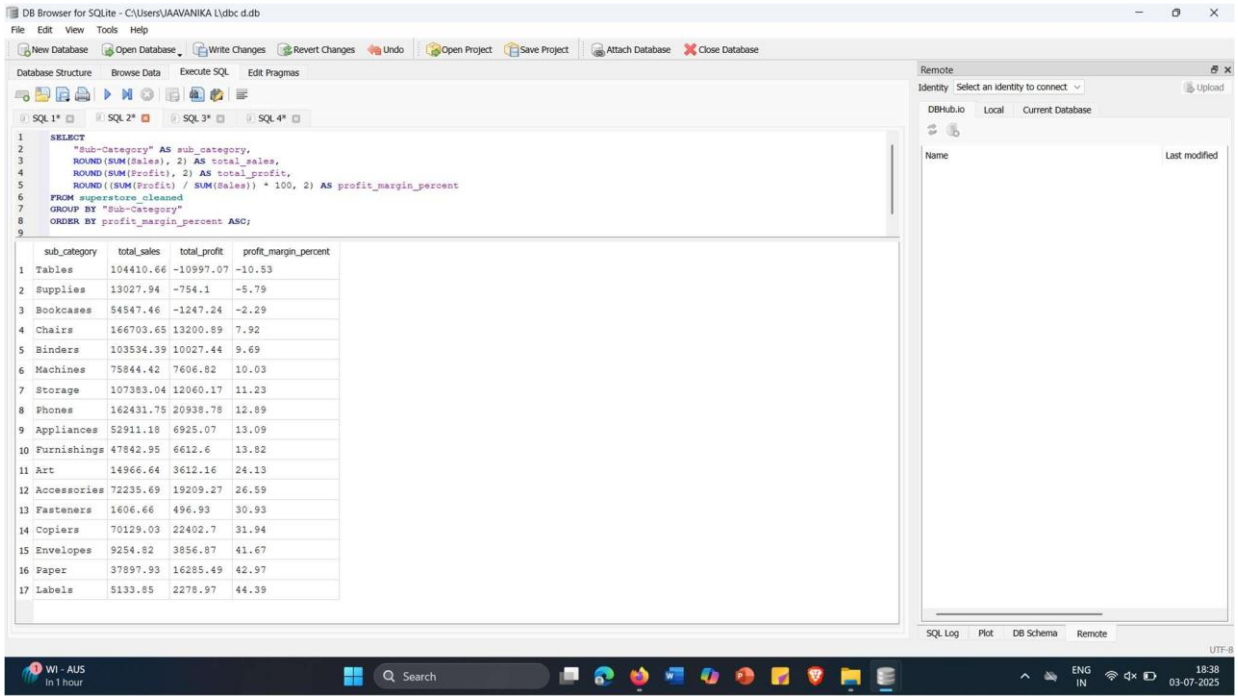
A. Profit by Category

```
SELECT
    "Category" AS category,
    ROUND(SUM(Sales), 2) AS total_sales,
    ROUND(SUM(Profit), 2) AS total_profit,
    ROUND((SUM(Profit) / SUM(Sales)) * 100, 2) AS
profit_margin_percent
FROM superstore_cleaned
GROUP BY "Category"
ORDER BY profit_margin_percent ASC;
```



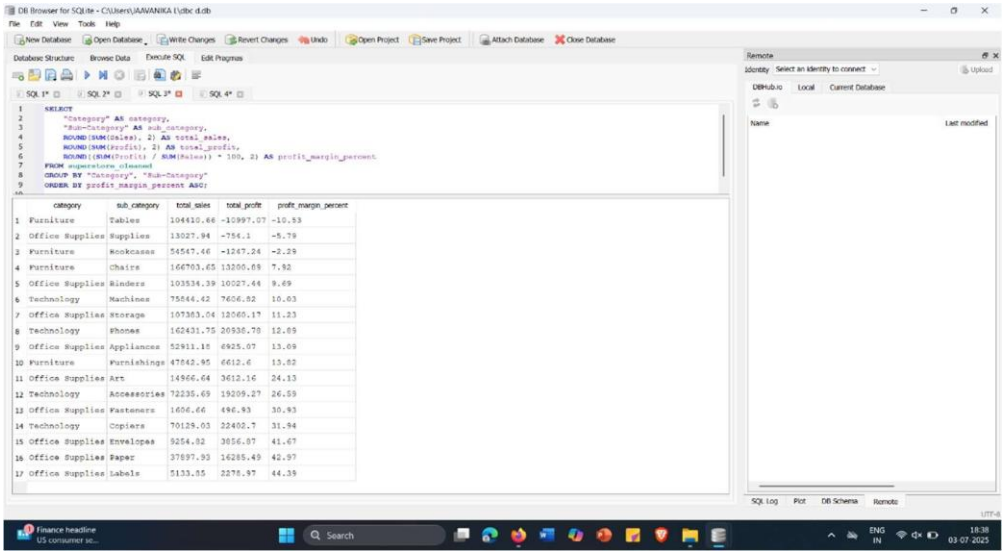
B. Profit by Sub-Category

```
SELECT
    "Sub-Category" AS sub_category,
    ROUND(SUM(Sales), 2) AS total_sales,
    ROUND(SUM(Profit), 2) AS total_profit,
    ROUND((SUM(Profit) / SUM(Sales)) * 100, 2) AS
profit_margin_percent
FROM superstore_cleaned
GROUP BY "Sub-Category"
ORDER BY profit_margin_percent ASC;
```



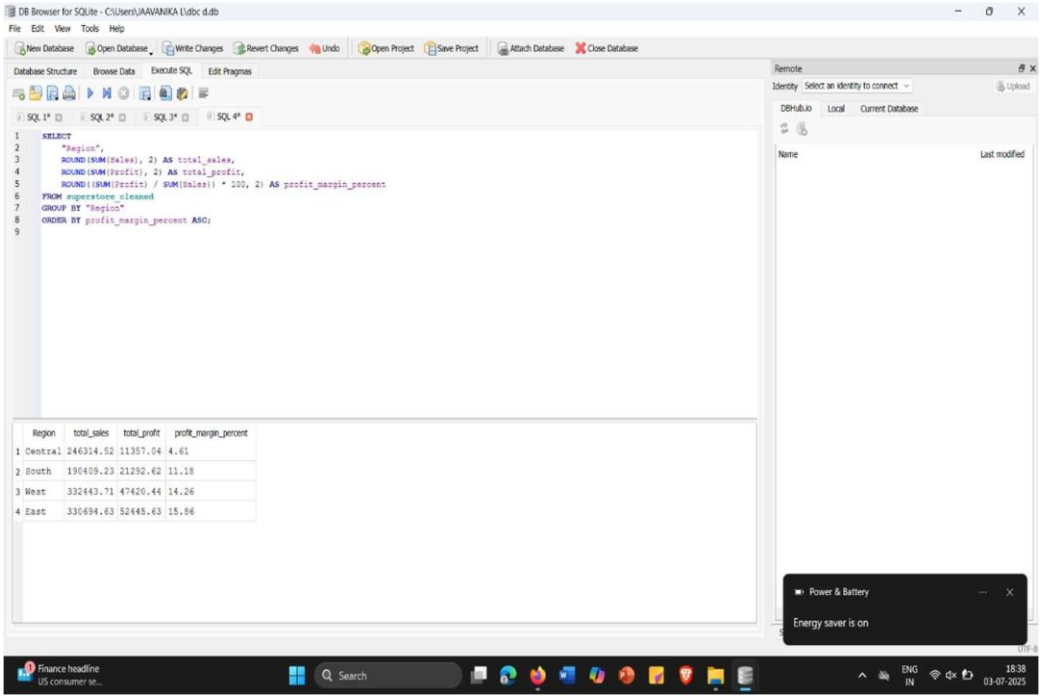
C. Profit by Category + Sub-Category

```
SELECT
    "Category" AS category,
    "Sub-Category" AS sub_category,
    ROUND(SUM(Sales), 2) AS total_sales,
    ROUND(SUM(Profit), 2) AS total_profit,
    ROUND((SUM(Profit) / SUM(Sales)) * 100, 2) AS
profit_margin_percent
FROM superstore
GROUP BY "Category", "Sub-Category"
ORDER BY profit_margin_percent ASC;
```



D. Profit by Region

```
SELECT
    "Region",
    ROUND(SUM(Sales), 2) AS total_sales,
    ROUND(SUM(Profit), 2) AS total_profit,
    ROUND((SUM(Profit) / SUM(Sales)) * 100, 2) AS
profit_margin_percent
FROM superstore
GROUP BY "Region"
ORDER BY profit_margin_percent ASC;
```



Step 3: Python – Correla on Between Inventory Days & Profitability
Visualiza ons (Python/Seaborn/Matplotlib) import pandas as pd
import numpy as np

# Load cleaned data
df = pd.read_csv("superstore_cleaned.csv")

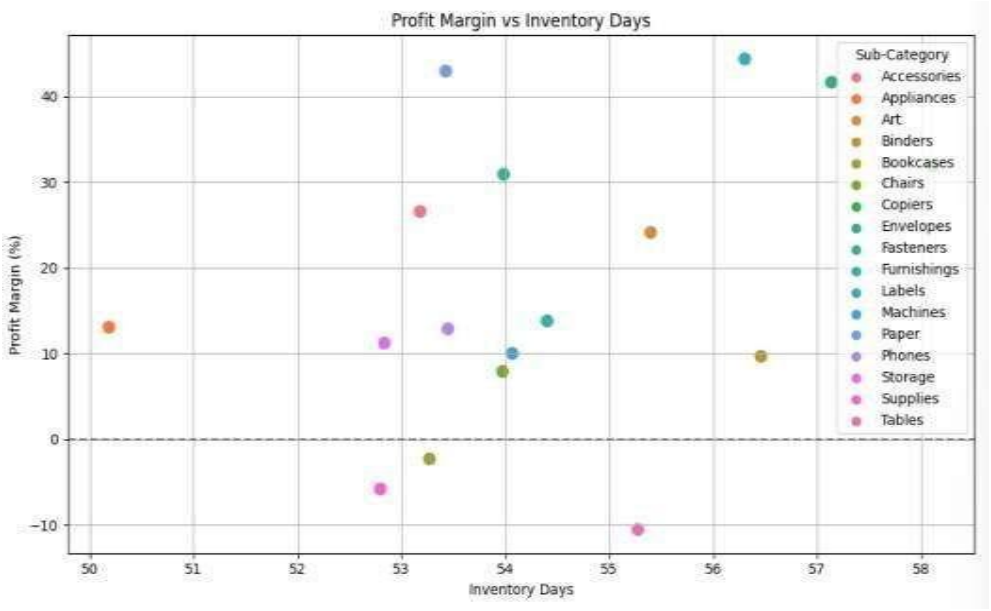
# Simulate Inventory Days (since not in original dataset)
np.random.seed(42)
df["Inventory Days"] = np.random.randint(10, 101, size=len(df))

Convert date columns to date me df["Order Date"]
= pd.to_date me(df["Order Date"]) df["Month"] =
df["Order Date"].dt.month df["Season"] = df["Month"].map({
12: "Winter", 1: "Winter", 2:
"Winter",
  3: "Spring", 4: "Spring", 5: "Spring",
  6: "Summer", 7: "Summer", 8: "Summer",
  9: "Fall", 10: "Fall", 11: "Fall"
})

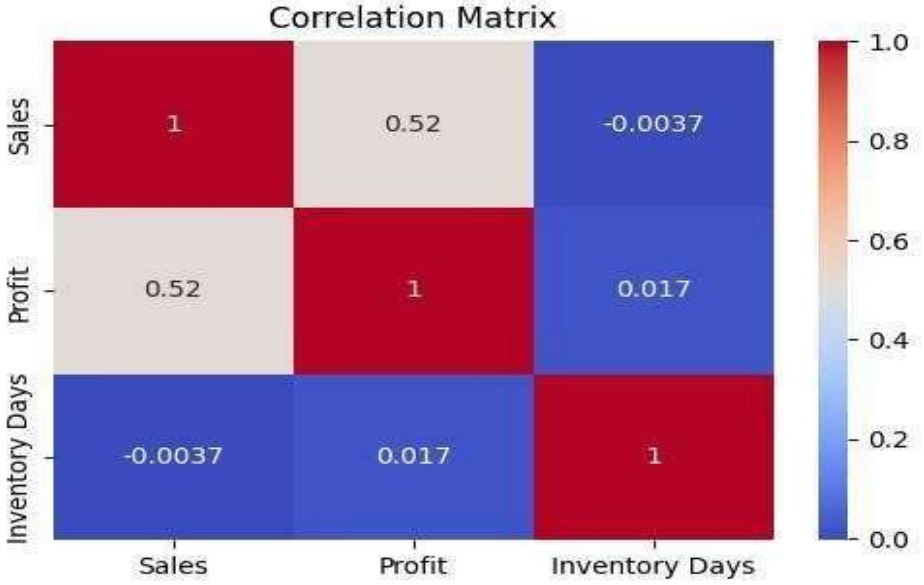
1. Sca er Plot: Inventory Days vs Profit Margin grouped = df.groupby("Sub-Category").agg({
   "Sales": "sum",
   "Profit": "sum",
   "Inventory Days": "mean"
   }).reset_index()
   grouped["Profit Margin (%)"] = (grouped["Profit"] / grouped["Sales"]) * 100

   import seaborn as sns
   import matplotlib.pyplot as plt

   plt.figure(figsize=(10,6))
   sns.sca erplot(data=grouped, x="Inventory Days", y="Profit Margin (%)",
   hue="Sub-Category", s=100) plt. tle("Profit Margin vs Inventory Days")
   plt.axhline(0, linestyle='--', color='gray') plt.grid(True) plt. ght_layout()
   plt.show()



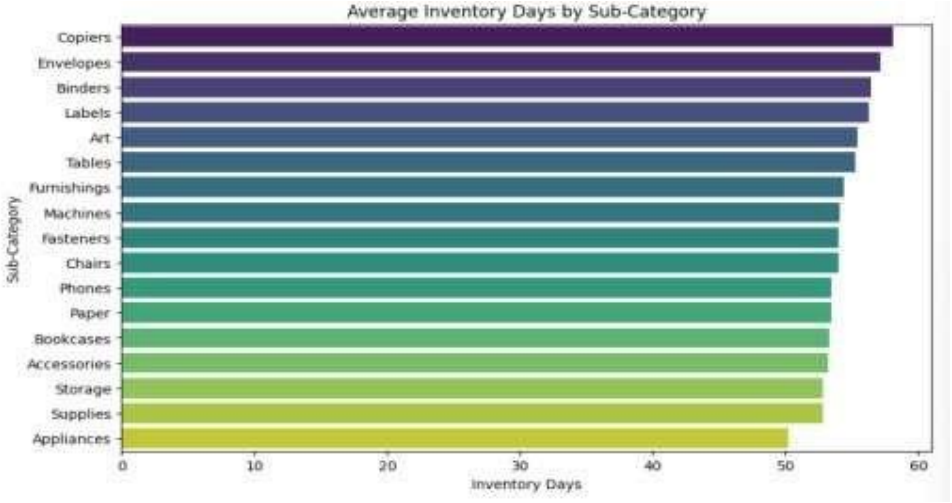
2. Heatmap: Inventory Days vs Profit Margin (Correla on Matrix) # Correla on between numeric columns plt.figure(figsize=(6,4)) sns.heatmap(df[["Sales", "Profit", "Inventory Days"]].corr(), annot=True, cmap='coolwarm') plt. tle("Correla on Matrix") plt.show()



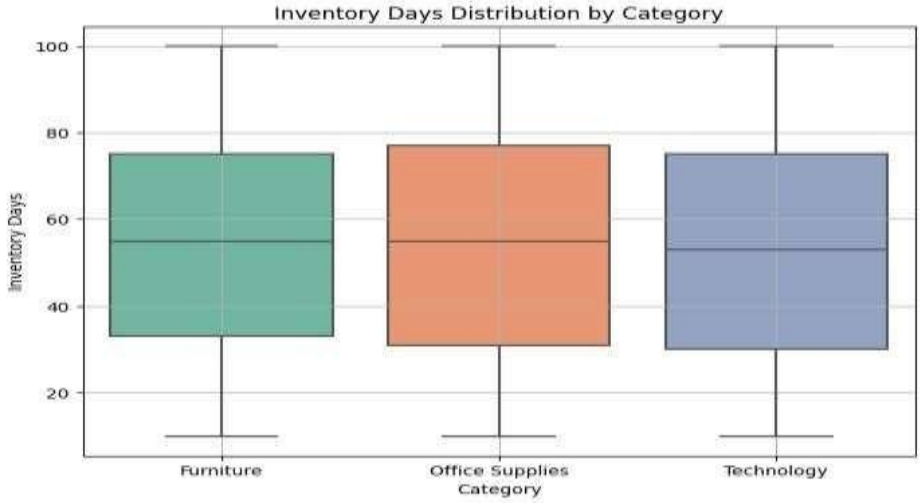
3. Bar Chart: Sub-Categories with Highest Inventory Days inv_days = df.groupby("Sub-Category")["Inventory Days"].mean().sort_values(ascending=False)

   plt.figure(figsize=(10,6))

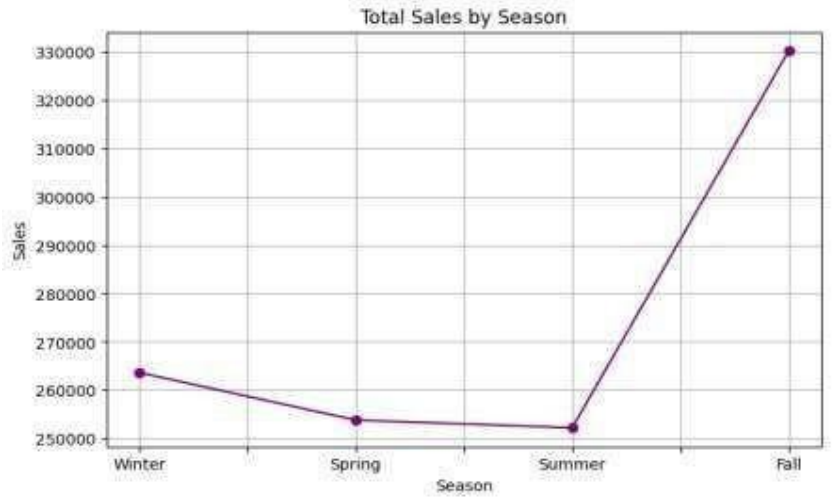
sns.barplot(x=inv_days.values, y=inv_days.index, pale e="viridis") plt. tle("Average Inventory Days by Sub-Category") plt.xlabel("Inventory Days") plt.ylabel("Sub-Category") plt.show()



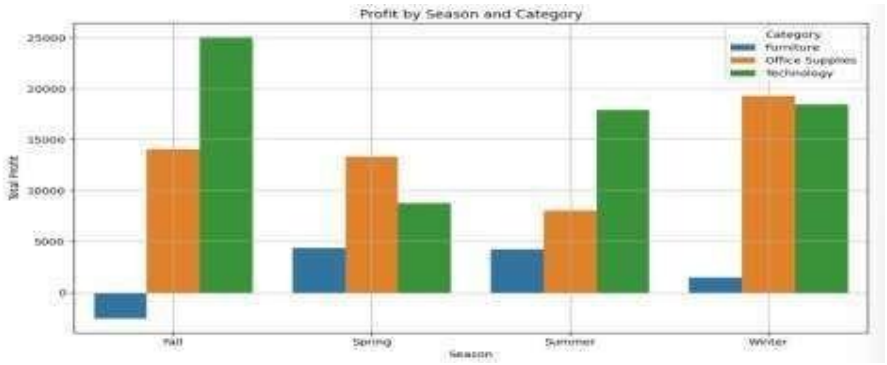
4. Box Plot: Inventory Days Distribu on by Category plt.figure(figsize=(8,6)) sns.boxplot(data=df, x="Category", y="Inventory Days", pale e="Set2") plt. tle("Inventory Days Distribu on by Category") plt.grid(True) plt.show()



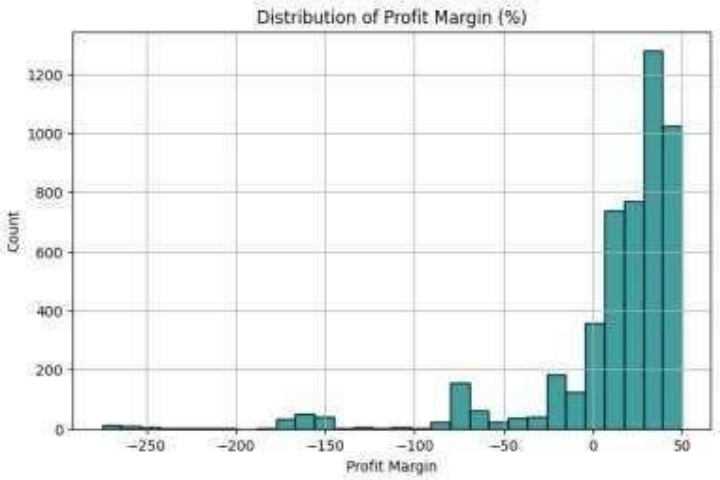
5. Seasonal Sales Trend (Line Plot by Season) season_sales = df.groupby("Season")["Sales"].sum().reindex(["Winter", "Spring", "Summer", "Fall"]) plt.figure(figsize=(8,5)) season_sales.plot(kind="line", marker='o', color="purple") plt. tle("Total Sales by Season") plt.xlabel("Season") plt.ylabel("Sales") plt.grid(True) plt.show()



6. Profitability by Season & Category (Grouped Bar Chart) season_cat = df.groupby(["Season", "Category"])["Profit"].sum().reset_index()
   plt.figure(figsize=(10,6))
   sns.barplot(data=season_cat, x="Season", y="Profit", hue="Category") plt.
   tle("Profit by Season and Category")
   plt.ylabel("Total Profit")
   plt.grid(True) plt.
   ght_layout() plt.show()



7. Histogram: Distribu on of Profit Margins df["Profit Margin (%)"] = (df["Profit"] / df["Sales"]) * 100 plt.figure(figsize=(8,5)) sns.histplot(df["Profit Margin (%)"], bins=30, color="teal")
   plt. tle("Distribu on of Profit Margin (%)") plt.xlabel("Profit Margin")
   plt.grid(True) plt.show()



8. Sub-Category Level Comparison (Bar Chart) sub_profit = df.groupby("Sub-Category")["Profit"].sum().sort_values()
   plt.figure(figsize=(10,6))
   sns.barplot(x=sub_profit.values, y=sub_profit.index, pale e="coolwarm")
   plt. tle("Total Profit by Sub-Category") plt.xlabel("Profit")
   plt.ylabel("SubCategory") plt.axvline(0, color="black", linestyle="--")
   plt.show()