Retail Business Performance & Profitability Analysis

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1. Project Overview

This project aims to analyze transactional retail data to improve profitability by identifying underperforming product categories, optimizing inventory turnover, and uncovering seasonal sales trends. The analysis helps guide strategic decisions to reduce losses, improve stock movement, and target high-performing segments.

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2. Objectives

- Identify profit-draining categories and sub-categories
- Correlate inventory days with profitability
- Detect seasonal product performance patterns
- Provide insights for reducing overstock and improving turnover
- Deliver an interactive dashboard for business users

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3. Tools Used

- **SQL (via Google Colab)** – Data cleansing, filtering, and aggregations
- **Python (Pandas, Seaborn)** – Exploratory Data Analysis and visual correlation
- **Power BI** – Visual dashboard with filters and KPIs

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4. Data Overview

A mock dataset of 1000 retail transactions was generated with the following columns:

- Order ID
- Product Name, Category, Sub-Category
- Region
- Order Date, Delivery Date, Season

- Sales, Cost, Profit
- Inventory Days
- Units Sold

The data was cleaned and null/missing values were removed prior to analysis.

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5. Key Analyses & Findings

5.1 Profit Margin by Category & Sub-Category

- Profit margins varied significantly across sub-categories.
- Categories such as **Stationery** and **Office Supplies** had high sales volume but low profitability.
- **Electronics** showed the highest average margin but also the highest holding costs.

5.2 Correlation Between Inventory Days & Profit

- A negative correlation was found between **inventory days** and **profit margins**, indicating that longer stock holding reduces profitability.
- Overstocked items with low turnover were primarily from **Furniture** and **Seasonal Items**.

5.3 Seasonal Sales Patterns

- Seasonal peaks were observed in **Q4 (Winter)** for categories like **Toys** and **Apparel**.
- **Spring and Summer** favored **Garden Supplies** and **Outdoor Equipment**.
- These trends help determine when to increase or decrease stock levels.

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6. Strategic Recommendations

- **Discontinue or Discount Slow-Moving Items:** Sub-categories with low profitability and high inventory days should be discounted or cleared quickly.
- **Seasonal Stock Planning:** Allocate higher inventory before seasonal demand surges (e.g., Toys in Winter).
- **Replenish Fast-Moving, High-Profit Items:** Focus restocking on high-demand sub-categories like Electronics, Kitchen Appliances, and Accessories.

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7. Power BI Dashboard Highlights

The dashboard includes:

- **Profit Margin by Category/Sub-category** (Bar Chart)
- **Sales & Profit by Season** (Line Chart)
- **Low-Profit, High Inventory Items** (Filtered Table)
- **KPIs:** Total Sales, Total Profit, Avg. Inventory Days
- **Filters:** Region, Category, and Season

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8. Project Limitations

- Mock data was used and may not reflect real business conditions
- Seasonal classification was based on delivery date only
- External factors like marketing campaigns or regional events were not included

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9. Future Scope / Real-Time Integration

This project can be extended into a real-time system by:

- Connecting Power BI to a live SQL database (MySQL/PostgreSQL)
- Automating data updates via forms or Point-of-Sale systems
- Scheduling regular dashboard refresh in Power BI Service

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10. Conclusion

The analysis helped identify areas where inventory management and category profitability can be improved. Through SQL, Python, and Power BI, this project provides data-backed insights and actionable recommendations to help drive retail business performance and profitability.
