🏬 Retail Inventory & Replenishment Optimizer

(SQL | MySQL)

📌 Project Overview

This project analyzes retail sales, inventory, and supplier data to evaluate inventory health, demand variability, and replenishment risks across products and stores. The goal is to support data-driven inventory planning, minimize stockout risks, and optimize working capital utilization using SQL-based analysis.

🎯 Business Objectives

- ★ Assess overall inventory health and demand patterns
- ★ Identify fast-moving and high-risk SKUs
- ★ Detect uneven demand across stores and categories
- ★ Evaluate supplier lead-time and MOQ constraints
- ★ Support proactive replenishment and inventory optimization

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📁 Dataset Description

The project uses five realistic retail datasets:

File Name	Description
products.csv	SKU master data (product, category, unit cost)
stores.csv	Store-level details and regions
sales.csv	Transaction-level sales data
inventory_snapshots.csv	Store-SKU inventory snapshots

suppliers.csv	Supplier constraints (lead time, MOQ, pack size)

🧠 Analysis Workflow

1️⃣ Step 1: Data Understanding & Sanity Checks

- ❖ Validated record counts, nulls, duplicates
- ❖ Verified SKU, store, and supplier consistency
- ❖ Confirmed sales and inventory data integrity

2️⃣ Step 2: Core Business Analysis

- ❖ Identified fast-moving and revenue-driving SKUs
- ❖ Analyzed store-level revenue concentration
- ❖ Evaluated category-level demand patterns
- ❖ Assessed overall inventory health

3️⃣ Step 3: Inventory Risk & Demand Patterns

- ❖ Analyzed demand variability across SKUs
- ❖ Identified uneven demand and localized inventory risks
- ❖ Highlighted categories needing tighter planning

4️⃣ Step 4: Advanced Inventory & Replenishment Analysis

- ❖ Evaluated supplier lead-time exposure
- ❖ Assessed MOQ-driven working capital pressure
- ❖ Identified early warning signals for stockout risks
- ❖ Reviewed excess inventory scenarios

5️⃣ Step 5: Executive-Level Insights & Recommendations

- ❖ Translated analysis into business actions
- ❖ Designed proactive inventory optimization strategies

🔍 Key Business Insights

1️⃣ Inventory & Demand

- ❖ Fast-moving SKUs present higher future stockout risk

- Demand is uneven across stores and product categories
- High revenue does not always correlate with high volume

2️⃣ Inventory Health

- No immediate stockouts detected
- Inventory levels are generally aligned with demand
- Localized inventory pressure exists due to uneven demand

3️⃣ Category-Level Observations

- Apparel requires higher safety stock due to demand volatility
- Beauty and Stationery require tighter inventory controls

4️⃣ Supplier Constraints

- High-demand SKUs with long lead times increase stockout exposure
- High MOQ requirements create working capital pressure

💡 Business Recommendations

- Prioritize fast-moving and high-variability SKUs for tighter controls
- Implement early-warning inventory coverage indicators
- Apply category-specific inventory and safety stock policies
- Optimize replenishment frequency for high-demand stores
- Renegotiate supplier MOQ and lead-time terms
- Monitor demand variability to prevent future stockouts

💼 Overall Business Value Delivered

- Improved visibility into inventory and replenishment risks
- Enabled proactive inventory management strategies
- Reduced potential cash flow and working capital inefficiencies
- Supported scalable, data-driven retail decision-making
- Strengthened operational resilience

🛠️ SQL Concepts Used

- ❖ JOINs (INNER)
- ❖ GROUP BY & HAVING
- ❖ Aggregate functions
- ❖ Subqueries
- ❖ Date filtering & window logic
- ❖ Business KPI calculations

📊 Tools & Used

- ★ MySQL Workbench
- ★ SQL
- ★ Python (for data generation)
- ★ GitHub

🧑🏻 Author

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