Final Project: Inventory Management Solution

CNIT 37200

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EXECUTIVE SUMMARY

The Inventory Management Solution project focuses on developing a comprehensive inventory management solution tailored to Walmart's unique scale and logistical challenges. This system aims to enhance Walmart's ability to accurately track stock levels, streamline reordering, and reduce overstock and stockouts. Given Walmart's vast network, a robust data management solution is essential for maintaining efficiency, reducing waste, and optimizing store inventory turnover. Our project implements advanced database systems, including well-defined relationships and triggers, to improve Walmart's data management capabilities.

The project yielded valuable insights and actionable solutions:

- Demand Patterns: Analyzed sales data to reveal demand trends based on seasonal and regional factors, allowing Walmart to forecast inventory needs better.
- Stock Shortage Prevention: Developed a predictive model that identifies potential stock shortages before they occur, providing Walmart with actionable insights to mitigate stockouts.
- Reorder Optimization: Calculated optimal reorder points by analyzing supplier lead times and historical sales, improving stock availability, and minimizing excess inventory.
- Supplier Performance: Enhanced Walmart's understanding of supplier reliability by recording and analyzing delivery history, allowing adjustments to inventory management based on supplier performance.
- Data Integrity and Security: Implemented rigorous normalization and security measures to ensure data accuracy, prevent unauthorized access, and maintain inventory integrity across the system.

INTRODUCTION

Subject Domain

Our project resides within retail inventory management, focusing on how data systems can drive efficient stock handling in large-scale retail environments. As one of the largest retailers, Walmart's extensive inventory requires constant monitoring and adjustments to align supply with demand accurately. Effective data management in inventory ensures that Walmart can maintain high levels of customer satisfaction and operational efficiency, which are critical to its success.

Real-World Problem

The primary problem addressed in this project is Walmart's struggle to maintain accurate inventory levels due to the complexity of handling large data volumes across numerous stores. Current inefficiencies in the inventory tracking system result in overstock (leading to increased storage costs) and stockouts (affecting sales and customer satisfaction). This project aims to solve these issues by creating a system capable of tracking, analyzing, and predicting inventory needs. This effort ensures that Walmart can align its stock with fluctuating demand patterns, ultimately enhancing customer experience and reducing operating costs.

Project Objectives

The following are the main project objectives that act as a measurement of success:

- Implement a system that ensures up-to-date inventory data across Walmart's network.
- Utilize data to forecast demand patterns and recommend optimized stock levels.
- Analyze and track supplier lead times and delivery history to better coordinate reorders.
- Apply security measures and ensure data integrity to prevent errors and unauthorized data manipulation.

DATABASE DESIGN AND IMPLEMENTATION

Our database schema includes four core tables: Products, Inventory, Sales Transactions, and Suppliers. Each table fulfills a unique role in the inventory management system, and together, they allow for a comprehensive view of Walmart's inventory lifecycle.

Table Outlines

- **Inventory**: information about products and their stock levels will be stored in each store.
- **Sales Transactions**: record each sale, linking it to the product and the store.
- **Suppliers**: will store supplier details and link to products to track supplier performance.
- **Products**: This table stores product information, including unique identifiers and descriptive names. It serves as the central reference point for other tables like Inventory and Suppliers, ensuring each product has a unique identity throughout the system.

Database Design

In the following list, here are some of the column names, data types, and constraints that we might use in our database

1. **Products Table:**
    - Product_ID (INT, Primary Key, NOT NULL): Unique identifier for products.
    - Product_Name (VARCHAR(50), NOT NULL): Descriptive name of the product.
2. **Inventory Table**:
    - Product_ID (INT, Foreign Key, NOT NULL): Unique identifier for products (links to the Products table).
    - Store_ID (INT, Primary Key, NOT NULL): Unique identifier for stores.

- Stock_Level (INT, NOT NULL, CHECK >= 0): Current stock count of the product.
- Stock_Status_Date (DATE, NOT NULL): Tracks the date of stock status updates.
- Stock_Status (VARCHAR(20), NOT NULL): Describes the stock status (e.g., "In Stock", "Low Stock").

3. **Sales Transactions Table**:
   - Transaction_ID (INT, Primary Key, NOT NULL): Unique identifier for each sale.
   - Product_ID (INT, Foreign Key, NOT NULL): Links to the product in the Inventory table.
   - Store_ID (INT, Foreign Key, NOT NULL): Links to the store in the Inventory table.
   - Quantity_Sold (INT, NOT NULL, CHECK > 0): Number of units sold.
   - Sale_Date (DATE, NOT NULL): Date of the transaction.
4. **Suppliers Table**:
   - Supplier_ID (INT, Primary Key, NOT NULL): Unique identifier for suppliers.
   - Product_ID (INT, Foreign Key, NOT NULL): Links to the product in the Products table.
   - Lead_Time (INT, NOT NULL, CHECK >= 0): Days required for delivery.
   - Delivery_History (VARCHAR(125)): Tracks delivery performance data.

Relationships Between Tables

Understanding relationships between tables in a database is crucial for managing and analyzing data effectively. These connections, often made through shared fields, link related

information across different tables. Such relationships enable a comprehensive data view, supporting better decision-making and operational management.

- The inventory and Sales Transaction tables are linked via Product_ID and Store_ID, which allows tracking of stock levels relative to sales.
- Inventory and Suppliers tables are linked via Product_ID, allowing insights into how supplier lead times affect stock levels and reorder efficiency.
- Products serve as the central table, linking to Inventory and Suppliers, ensuring that every product tracked in inventory or supplied has a unique identity in the system.

Normalization Process

Normalization is a crucial process in database design that ensures data is organized efficiently, minimizes redundancy, and improves data integrity. For our inventory management system, we applied the following normalization steps:

- **First Normal Form (1NF):** Each table has been structured to ensure that every column contains atomic values and no repeating groups. For instance, in the **Products** table, each has a unique Product_ID and a single Product_Name, ensuring no column contains multiple values.
- **Second Normal Form (2NF):** All non-primary key attributes fully depend on the primary key. In the **Inventory** table, attributes such as Stock_Level, Stock_Status, and Stock_Status_Date depend on the Product_ID and Store_ID (composite key), ensuring that each product in each store is uniquely identified and tracked without redundancy.
- **Third Normal Form (3NF):** We ensured that no transitive dependencies exist, meaning non-key attributes are not dependent on other non-key attributes. For example, in the

Sales Transactions table, attributes like Quantity_Sold and Sale_Date are directly related to the Transaction_ID and not reliant on different fields such as Product_ID or Store_ID. This ensures that data is not duplicated across the system.

By normalizing the database, we aim to:

- Eliminate redundant data and avoid inconsistencies across tables.
- Facilitate efficient data retrieval for queries such as tracking stock levels, analyzing supplier performance, and identifying sales trends across stores.

This approach helps ensure the database structure is optimized for the specific needs of the inventory management system, allowing for accurate and reliable operations as the dataset grows.

Database ER Diagram

This Entity-Relationship Diagram (ERD) models the structure of a retail inventory management system, illustrating the relationships between four key entities: Products, Inventory, Suppliers, and Sales Transactions. The Products table serves as a central entity, uniquely identifying each product in the system. The Inventory table tracks product stock levels across multiple stores, linking products to specific stores. The Sales Transactions table records each sale, detailing the product, store, quantity sold, and date. The Suppliers table stores information about suppliers and their relationship to products, including lead times and delivery history. The relationships are designed to ensure data integrity and efficient product stock management, supplier performance, and sales activities within the system.

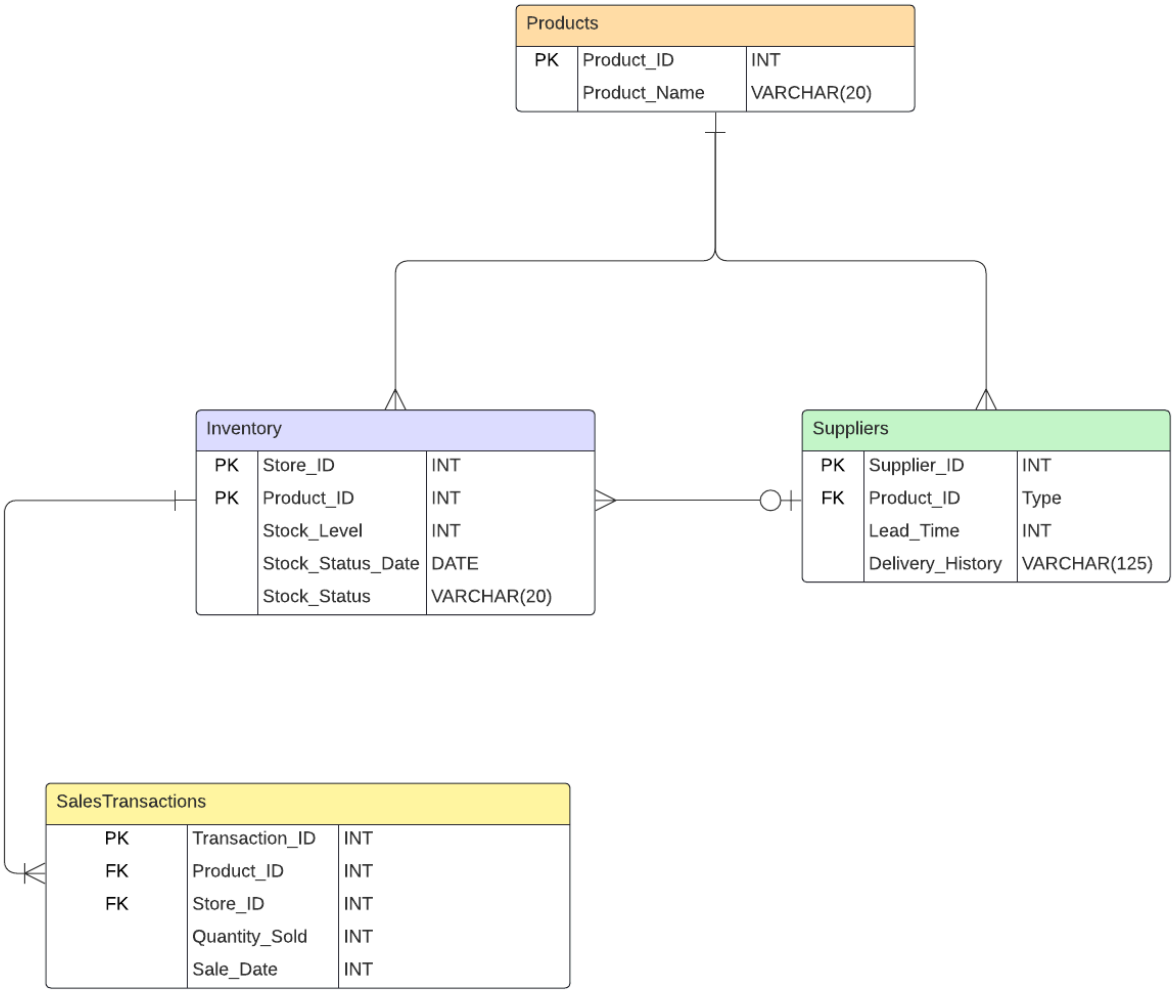

Figure 1: Inventory Management System's ERD Diagram

PROBLEM SOLVING AND QUESTIONS ANSWERED

This section revisits the ten key questions developed in Milestone 1, each addressing critical aspects of Walmart's inventory management. Reflections under each question highlight how the group tackled these challenges using tailored PL/SQL scripts.

Question List

The following are the ten questions that your project will answer:

1. What patterns in product demand can be observed across different regions and seasons?
    a. We aggregated sales data by store location and month to capture seasonal and regional demand trends. The system identifies high-demand periods for specific products in various places by analyzing sales totals for each store over different months. This helps Walmart allocate inventory more effectively, ensuring adequate stock during peak demand times in each region.
2. How can we predict stock shortages before they occur?
    a. We implemented a procedure that calculates the average monthly sales for each product at each store and compares it with the current stock level. The procedure prompts a reorder suggestion if the stock falls below this average. This proactive approach helps Walmart minimize stockouts, ensuring products remain available for customers without requiring manual monitoring.
3. What factors contribute to overstock situations?
    a. Our query identifies products with high stock levels but low sales, allowing Walmart to pinpoint overstocked items that need to be moving quickly. This information helps adjust future orders, potentially reducing quantities for products

that tend to accumulate and optimizing space and resources by decreasing unnecessary overstock.

4. How can Walmart optimize reorder points for various product categories?
    a. We calculated reorder points using average lead times from suppliers and historical sales rates for each product. By setting reorder levels based on demand and supplier lead time, the system ensures that stock is replenished before it runs out, particularly for high-turnover items. This method balances availability with cost efficiency, optimizing stock without excessive surplus.
5. What is the impact of inaccurate inventory data on sales performance?
    a. This query identifies cases where sales could not be completed due to insufficient or inaccurate stock levels. By analyzing instances where requested quantities exceeded available stock, Walmart can gain insights into the consequences of data inaccuracies on sales. Addressing these issues helps improve data quality, directly impacting customer satisfaction and reducing potential revenue loss from unfulfilled orders.
6. How can Walmart improve supplier lead time estimates?
    a. To enhance lead time accuracy, we calculated the average delivery times from each supplier based on records. By understanding the typical delivery duration for each supplier, Walmart can make more informed reorder decisions. This approach allows the company better to align stock replenishment schedules with actual supplier performance, reducing waiting times and ensuring timely restocking.
7. Which products have the highest return rates, and how does this impact inventory management?

   a. We tracked product return rates by analyzing transactions with negative quantities (indicating returns). High return rates may suggest quality issues or misalignment with customer preferences, prompting Walmart to review these items. By identifying and managing high-return products, Walmart can adjust inventory strategies and avoid overstocking items that are likely to be returned.

8. How can Walmart reduce the time it takes to restock shelves after sell-outs?
   a. A dedicated procedure checks stock levels for items with zero inventory and suggests immediate restocking based on supplier lead times. This system flags out-of-stock products that can be quickly reordered to meet demand, reducing the time shelves remain empty and enhancing customer product availability.
9. How can the system identify slow-moving items and adjust stock levels accordingly?
   a. This query identifies products with minimal sales over the past six months, allowing Walmart to classify them as slow-moving items. By recognizing products with persistently low demand, Walmart can make informed decisions to decrease order quantities, thereby minimizing overstock and associated holding costs for items with low turnover.
10. What impact do return rates have on inventory management?
    a. We calculated each product's return rate as a percentage of its total sales to assess its effect on inventory. High return rates indicate the need for a review of certain products, whether for quality improvement or marketing adjustments. Monitoring return rates assist Walmart in maintaining a healthy stock balance by considering sales and the likelihood of returns, thus refining overall inventory accuracy.

Each question reflects a specific operational challenge addressed by your database design

and PL/SQL queries, enabling data-driven solutions for Walmart's inventory management. For detailed code implementations of each solution, please reference the Appendix C.

ADVANCED FEATURES AND SECURITY

Triggers

A trigger was implemented on the Inventory table to monitor stock levels. When the Stock_Level for a product falls below a predefined threshold, the trigger executes a procedure to notify the appropriate personnel for reorder. A trigger ensures that whenever a sale is recorded in the SalesTransactions table, the corresponding stock level in the Inventory table is automatically reduced by the Quantity_Sold value. A trigger on the Inventory table prevents updates that would result in negative stock levels, ensuring data integrity and operational correctness.

Constraints

The primary and foreign key ensures referential integrity between the tables.
The Product_ID is a primary key in the Products table and a foreign key in the Inventory, SalesTransactions, and Suppliers tables. A composite primary key (Store_ID, Product_ID) in the Inventory table ensures uniqueness for each product in a specific store. The Stock_Level in the Inventory table has a CHECK (Stock_Level >= 0) constraint to prevent negative stock levels. The Quantity_Sold in the SalesTransactions table has a CHECK (Quantity_Sold > 0) constraint, ensuring only valid sales quantities are recorded. The Lead_Time in the Suppliers table has a CHECK (Lead_Time >= 0) to validate positive delivery times. The Unique Constraints: Ensures there are no duplicate entries for critical identifiers like Transaction_ID, Product_ID, or Supplier_ID.

Security Measures

For Data Access Controls, Role-Based Access Control (RBAC) has different roles that were defined with varying levels of access:

- Admins have full privileges across all tables.

- Inventory Managers can modify Inventory and Suppliers tables but have read-only access to SalesTransactions.
- Sales Associates can only insert records into SalesTransactions.

For encryption, sensitive columns such as Delivery_History and Sale_Date are encrypted to prevent unauthorized access. This ensures data confidentiality during storage and transmission. For audit trail, logging contains All CRUD operations on critical tables (Inventory, SalesTransactions) that are logged in an audit table to track changes, identify anomalies, and support regulatory compliance. The triggers for Audit Logging are INSERT, UPDATE, and DELETE operations that record details like User_ID, timestamp, and changes into the audit table. To Preventing SQL Injection, the use of bind variables in PL/SQL procedures and functions to sanitize inputs were implemented. The use of validation checks within stored procedures to filter out potentially malicious data were also incorporated. For backup and recovery, regular backups of the database ensure that sensitive data can be restored in the event of a failure. Transactions are also designed with commit and rollback mechanisms to maintain database consistency in case of an error. Implementing these measures can ensure that the system has high data integrity, security, operational reliability, and increased efficiency.

GROUP CONTRIBUTIONS

Team Members' Contributions

Team Member	Contribution
Samuel Gomez	Project Manager & Data Engineer
Nicholas Lauw	Data Governance & Data Engineer
Noah Zhou	Project Coordinator & Quality Assurance Specialist
John Hsu	Data Architect & Engineer

Collaboration

Our group worked exceptionally well together from the start, immediately forming a group chat to facilitate communication. Everyone was very active in sending and responding to messages, ensuring that we all stayed informed and engaged. We had a clear division of roles, which helped streamline our efforts and maintain focus. The primary challenge we faced was finding appropriate times to meet due to conflicting schedules. However, we overcame this by maintaining excellent communication. If a group member was unable to meet on a certain day, we tried to find a different day where everyone could attend a short meeting. If a group member absolutely could not attend a meeting, we proceeded to meet as planned and made sure to fill them in on the details afterward. This approach ensured that everyone remained on the same page and contributed effectively to the project's success.

CONCLUSION

Project Reflection

The overall project experience was incredibly rewarding. We delved into various aspects of database programming, learning to implement data, PL/SQL procedures, functions, triggers, and constraints. Additionally, we worked on packages, CRUD operations, and PL/SQL efficiency. All of this was done within the context of creating a database system that could be applied in real-world scenarios, essentially focusing on the backend of an application. What went particularly well was the successful implementation of the various components mentioned above. However, there is always room for improvement. Potential enhancements could include expanding the dataset and incorporating more procedures, functions, triggers, and constraints where necessary.

Future Work

Looking ahead, there are several potential improvements and extensions for our project. One significant area for future work is developing the front-end, as our current project primarily focused on the backend. Additionally, making the project scalable to handle larger datasets and more complex operations would be a valuable enhancement. These improvements would not only broaden the scope of our project but also increase its applicability and robustness in real-world applications.

APPENDIX A: CREATION AND POPULATION OF TABLES

The following SQL script is designed to create and populate tables for a retail inventory management system. The database schema consists of four core tables: Products, Inventory, SalesTransactions, and Suppliers. These tables model the relationships between products, store stock levels, sales transactions, and suppliers. Each table has appropriate data types and primary and foreign keys to ensure referential integrity. Following the table creation, a series of INSERT statements populate the tables with 50 rows of data, providing sufficient information to perform inventory tracking, demand forecasting, and supply chain analysis. These scripts are structured to be executed separately to import and initialize the database easily.

```
-- Create Products table
CREATE TABLE Products (
    Product_ID INT PRIMARY KEY NOT NULL,
    Product_Name VARCHAR(50) NOT NULL
);
-- Create Inventory table
CREATE TABLE Inventory (
    Store_ID INT NOT NULL,
    Product_ID INT NOT NULL,
    Stock_Level INT NOT NULL CHECK (Stock_Level >= 0),
    Stock_Status_Date DATE NOT NULL,
    Stock_Status VARCHAR(20) NOT NULL,
    PRIMARY KEY (Store_ID, Product_ID),
    FOREIGN KEY (Product_ID) REFERENCES Products(Product_ID)
);


-- Create Suppliers table
```

```
CREATE TABLE Suppliers (
    Supplier_ID INT PRIMARY KEY NOT NULL,
    Product_ID INT NOT NULL,
    Lead_Time INT NOT NULL CHECK (Lead_Time >= 0),
    Delivery_History VARCHAR(125),
    FOREIGN KEY (Product_ID) REFERENCES Products(Product_ID)
);
-- Create SalesTransactions table
CREATE TABLE SalesTransactions (
    Transaction_ID INT PRIMARY KEY NOT NULL,
    Product_ID INT NOT NULL,
    Store_ID INT NOT NULL,
    Quantity_Sold INT NOT NULL CHECK (Quantity_Sold >= 0),
    Sale_Date DATE NOT NULL,
    FOREIGN KEY (Product_ID, Store_ID) REFERENCES Inventory(Product_ID,
Store_ID)
);
-- 1. Insert data into Products table
INSERT INTO Products (Product_ID, Product_Name) VALUES (101, 'Product
A');
INSERT INTO Products (Product_ID, Product_Name) VALUES (102, 'Product
B');
INSERT INTO Products (Product_ID, Product_Name) VALUES (103, 'Product
C');
INSERT INTO Products (Product_ID, Product_Name) VALUES (104, 'Product
D');
INSERT INTO Products (Product_ID, Product_Name) VALUES (105, 'Product
E');
INSERT INTO Products (Product_ID, Product_Name) VALUES (106, 'Product
F');
INSERT INTO Products (Product_ID, Product_Name) VALUES (107, 'Product
G');
```

```
    INSERT INTO Products (Product_ID, Product_Name) VALUES (108, 'Product
H');

    INSERT INTO Products (Product_ID, Product_Name) VALUES (109, 'Product
I');

    INSERT INTO Products (Product_ID, Product_Name) VALUES (110, 'Product
J');

    INSERT INTO Products (Product_ID, Product_Name) VALUES (111, 'Product
K');

    INSERT INTO Products (Product_ID, Product_Name) VALUES (112, 'Product
L');

    INSERT INTO Products (Product_ID, Product_Name) VALUES (113, 'Product
M');

    INSERT INTO Products (Product_ID, Product_Name) VALUES (114, 'Product
N');

    INSERT INTO Products (Product_ID, Product_Name) VALUES (115, 'Product
O');

    INSERT INTO Products (Product_ID, Product_Name) VALUES (116, 'Product
P');

    INSERT INTO Products (Product_ID, Product_Name) VALUES (117, 'Product
Q');

    INSERT INTO Products (Product_ID, Product_Name) VALUES (118, 'Product
R');

    INSERT INTO Products (Product_ID, Product_Name) VALUES (119, 'Product
S');

    INSERT INTO Products (Product_ID, Product_Name) VALUES (120, 'Product
T');

    INSERT INTO Products (Product_ID, Product_Name) VALUES (121, 'Product
U');

    INSERT INTO Products (Product_ID, Product_Name) VALUES (122, 'Product
V');

    INSERT INTO Products (Product_ID, Product_Name) VALUES (123, 'Product
W');

    INSERT INTO Products (Product_ID, Product_Name) VALUES (124, 'Product
X');

    INSERT INTO Products (Product_ID, Product_Name) VALUES (125, 'Product
Y');

    INSERT INTO Products (Product_ID, Product_Name) VALUES (126, 'Product
Z');
```

```
    INSERT INTO Products (Product_ID, Product_Name) VALUES (127, 'Product
AA');

    INSERT INTO Products (Product_ID, Product_Name) VALUES (128, 'Product
BB');

    INSERT INTO Products (Product_ID, Product_Name) VALUES (129, 'Product
CC');

    INSERT INTO Products (Product_ID, Product_Name) VALUES (130, 'Product
DD');

    INSERT INTO Products (Product_ID, Product_Name) VALUES (131, 'Product
EE');

    INSERT INTO Products (Product_ID, Product_Name) VALUES (132, 'Product
FF');

    INSERT INTO Products (Product_ID, Product_Name) VALUES (133, 'Product
GG');

    INSERT INTO Products (Product_ID, Product_Name) VALUES (134, 'Product
HH');

    INSERT INTO Products (Product_ID, Product_Name) VALUES (135, 'Product
II');

    INSERT INTO Products (Product_ID, Product_Name) VALUES (136, 'Product
JJ');

    INSERT INTO Products (Product_ID, Product_Name) VALUES (137, 'Product
KK');

    INSERT INTO Products (Product_ID, Product_Name) VALUES (138, 'Product
LL');

    INSERT INTO Products (Product_ID, Product_Name) VALUES (139, 'Product
MM');

    INSERT INTO Products (Product_ID, Product_Name) VALUES (140, 'Product
NN');

    INSERT INTO Products (Product_ID, Product_Name) VALUES (141, 'Product
OO');

    INSERT INTO Products (Product_ID, Product_Name) VALUES (142, 'Product
PP');

    INSERT INTO Products (Product_ID, Product_Name) VALUES (143, 'Product
QQ');

    INSERT INTO Products (Product_ID, Product_Name) VALUES (144, 'Product
RR');

    INSERT INTO Products (Product_ID, Product_Name) VALUES (145, 'Product
SS');
```

```
      INSERT INTO Products (Product_ID, Product_Name) VALUES (146, 'Product
TT');

      INSERT INTO Products (Product_ID, Product_Name) VALUES (147, 'Product
UU');

      INSERT INTO Products (Product_ID, Product_Name) VALUES (148, 'Product
VV');

      INSERT INTO Products (Product_ID, Product_Name) VALUES (149, 'Product
WW');

      INSERT INTO Products (Product_ID, Product_Name) VALUES (150, 'Product
XX');

      -- 2. Insert data into Inventory table

      INSERT INTO Inventory (Store_ID, Product_ID, Stock_Level,
Stock_Status_Date, Stock_Status)

      VALUES (1, 101, 150, TO_DATE('2024-09-01', 'YYYY-MM-DD'), 'In Stock');

      INSERT INTO Inventory (Store_ID, Product_ID, Stock_Level,
Stock_Status_Date, Stock_Status)

      VALUES (1, 102, 10, TO_DATE('2024-09-02', 'YYYY-MM-DD'), 'Low Stock');

      INSERT INTO Inventory (Store_ID, Product_ID, Stock_Level,
Stock_Status_Date, Stock_Status)

      VALUES (2, 103, 0, TO_DATE('2024-09-03', 'YYYY-MM-DD'), 'Out of Stock');

      INSERT INTO Inventory (Store_ID, Product_ID, Stock_Level,
Stock_Status_Date, Stock_Status)

      VALUES (2, 104, 300, TO_DATE('2024-09-04', 'YYYY-MM-DD'), 'In Stock');

      INSERT INTO Inventory (Store_ID, Product_ID, Stock_Level,
Stock_Status_Date, Stock_Status)

      VALUES (3, 105, 200, TO_DATE('2024-09-05', 'YYYY-MM-DD'), 'In Stock');

      INSERT INTO Inventory (Store_ID, Product_ID, Stock_Level,
Stock_Status_Date, Stock_Status)

      VALUES (3, 106, 180, TO_DATE('2024-09-06', 'YYYY-MM-DD'), 'In Stock');

      INSERT INTO Inventory (Store_ID, Product_ID, Stock_Level,
Stock_Status_Date, Stock_Status)

      VALUES (4, 107, 0, TO_DATE('2024-09-07', 'YYYY-MM-DD'), 'Out of Stock');

      INSERT INTO Inventory (Store_ID, Product_ID, Stock_Level,
Stock_Status_Date, Stock_Status)
```

```
      VALUES (4, 108, 50, TO_DATE('2024-09-08', 'YYYY-MM-DD'), 'Low Stock');

      INSERT INTO Inventory (Store_ID, Product_ID, Stock_Level,
Stock_Status_Date, Stock_Status)

      VALUES (5, 109, 100, TO_DATE('2024-09-09', 'YYYY-MM-DD'), 'In Stock');

      INSERT INTO Inventory (Store_ID, Product_ID, Stock_Level,
Stock_Status_Date, Stock_Status)

      VALUES (5, 110, 10, TO_DATE('2024-09-10', 'YYYY-MM-DD'), 'Low Stock');

      INSERT INTO Inventory (Store_ID, Product_ID, Stock_Level,
Stock_Status_Date, Stock_Status)

      VALUES (6, 111, 200, TO_DATE('2024-09-11', 'YYYY-MM-DD'), 'In Stock');

      INSERT INTO Inventory (Store_ID, Product_ID, Stock_Level,
Stock_Status_Date, Stock_Status)

      VALUES (6, 112, 0, TO_DATE('2024-09-12', 'YYYY-MM-DD'), 'Out of Stock');

      INSERT INTO Inventory (Store_ID, Product_ID, Stock_Level,
Stock_Status_Date, Stock_Status)

      VALUES (7, 113, 80, TO_DATE('2024-09-13', 'YYYY-MM-DD'), 'In Stock');

      INSERT INTO Inventory (Store_ID, Product_ID, Stock_Level,
Stock_Status_Date, Stock_Status)

      VALUES (7, 114, 120, TO_DATE('2024-09-14', 'YYYY-MM-DD'), 'In Stock');

      INSERT INTO Inventory (Store_ID, Product_ID, Stock_Level,
Stock_Status_Date, Stock_Status)

      VALUES (8, 115, 70, TO_DATE('2024-09-15', 'YYYY-MM-DD'), 'Low Stock');

      INSERT INTO Inventory (Store_ID, Product_ID, Stock_Level,
Stock_Status_Date, Stock_Status)

      VALUES (8, 116, 250, TO_DATE('2024-09-16', 'YYYY-MM-DD'), 'In Stock');

      INSERT INTO Inventory (Store_ID, Product_ID, Stock_Level,
Stock_Status_Date, Stock_Status)

      VALUES (9, 117, 130, TO_DATE('2024-09-17', 'YYYY-MM-DD'), 'In Stock');

      INSERT INTO Inventory (Store_ID, Product_ID, Stock_Level,
Stock_Status_Date, Stock_Status)

      VALUES (9, 118, 90, TO_DATE('2024-09-18', 'YYYY-MM-DD'), 'Low Stock');

      INSERT INTO Inventory (Store_ID, Product_ID, Stock_Level,
Stock_Status_Date, Stock_Status)
```

```
      VALUES (10, 119, 0, TO_DATE('2024-09-19', 'YYYY-MM-DD'), 'Out of Stock');

      INSERT INTO Inventory (Store_ID, Product_ID, Stock_Level,
Stock_Status_Date, Stock_Status)

      VALUES (10, 120, 220, TO_DATE('2024-09-20', 'YYYY-MM-DD'), 'In Stock');

      INSERT INTO Inventory (Store_ID, Product_ID, Stock_Level,
Stock_Status_Date, Stock_Status)

      VALUES (11, 121, 80, TO_DATE('2024-09-21', 'YYYY-MM-DD'), 'Low Stock');

      INSERT INTO Inventory (Store_ID, Product_ID, Stock_Level,
Stock_Status_Date, Stock_Status)

      VALUES (11, 122, 150, TO_DATE('2024-09-22', 'YYYY-MM-DD'), 'In Stock');

      INSERT INTO Inventory (Store_ID, Product_ID, Stock_Level,
Stock_Status_Date, Stock_Status)

      VALUES (12, 123, 50, TO_DATE('2024-09-23', 'YYYY-MM-DD'), 'Low Stock');

      INSERT INTO Inventory (Store_ID, Product_ID, Stock_Level,
Stock_Status_Date, Stock_Status)

      VALUES (12, 124, 90, TO_DATE('2024-09-24', 'YYYY-MM-DD'), 'In Stock');

      INSERT INTO Inventory (Store_ID, Product_ID, Stock_Level,
Stock_Status_Date, Stock_Status)

      VALUES (13, 125, 0, TO_DATE('2024-09-25', 'YYYY-MM-DD'), 'Out of Stock');

      INSERT INTO Inventory (Store_ID, Product_ID, Stock_Level,
Stock_Status_Date, Stock_Status)

      VALUES (13, 126, 200, TO_DATE('2024-09-26', 'YYYY-MM-DD'), 'In Stock');

      INSERT INTO Inventory (Store_ID, Product_ID, Stock_Level,
Stock_Status_Date, Stock_Status)

      VALUES (14, 127, 150, TO_DATE('2024-09-27', 'YYYY-MM-DD'), 'In Stock');

      INSERT INTO Inventory (Store_ID, Product_ID, Stock_Level,
Stock_Status_Date, Stock_Status)

      VALUES (14, 128, 100, TO_DATE('2024-09-28', 'YYYY-MM-DD'), 'Low Stock');

      INSERT INTO Inventory (Store_ID, Product_ID, Stock_Level,
Stock_Status_Date, Stock_Status)

      VALUES (15, 129, 75, TO_DATE('2024-09-29', 'YYYY-MM-DD'), 'Low Stock');

      INSERT INTO Inventory (Store_ID, Product_ID, Stock_Level,
Stock_Status_Date, Stock_Status)
```

```
      VALUES (15, 130, 120, TO_DATE('2024-09-30', 'YYYY-MM-DD'), 'In Stock');

      INSERT INTO Inventory (Store_ID, Product_ID, Stock_Level,
Stock_Status_Date, Stock_Status)

      VALUES (16, 131, 10, TO_DATE('2024-10-01', 'YYYY-MM-DD'), 'Out of
Stock');

      INSERT INTO Inventory (Store_ID, Product_ID, Stock_Level,
Stock_Status_Date, Stock_Status)

      VALUES (16, 132, 130, TO_DATE('2024-10-02', 'YYYY-MM-DD'), 'In Stock');

      INSERT INTO Inventory (Store_ID, Product_ID, Stock_Level,
Stock_Status_Date, Stock_Status)

      VALUES (17, 133, 80, TO_DATE('2024-10-03', 'YYYY-MM-DD'), 'Low Stock');

      INSERT INTO Inventory (Store_ID, Product_ID, Stock_Level,
Stock_Status_Date, Stock_Status)

      VALUES (17, 134, 140, TO_DATE('2024-10-04', 'YYYY-MM-DD'), 'In Stock');

      INSERT INTO Inventory (Store_ID, Product_ID, Stock_Level,
Stock_Status_Date, Stock_Status)

      VALUES (18, 135, 110, TO_DATE('2024-10-05', 'YYYY-MM-DD'), 'In Stock');

      INSERT INTO Inventory (Store_ID, Product_ID, Stock_Level,
Stock_Status_Date, Stock_Status)

      VALUES (18, 136, 60, TO_DATE('2024-10-06', 'YYYY-MM-DD'), 'Low Stock');

      INSERT INTO Inventory (Store_ID, Product_ID, Stock_Level,
Stock_Status_Date, Stock_Status)

      VALUES (19, 137, 0, TO_DATE('2024-10-07', 'YYYY-MM-DD'), 'Out of Stock');

      INSERT INTO Inventory (Store_ID, Product_ID, Stock_Level,
Stock_Status_Date, Stock_Status)

      VALUES (19, 138, 200, TO_DATE('2024-10-08', 'YYYY-MM-DD'), 'In Stock');

      INSERT INTO Inventory (Store_ID, Product_ID, Stock_Level,
Stock_Status_Date, Stock_Status)

      VALUES (20, 139, 150, TO_DATE('2024-10-09', 'YYYY-MM-DD'), 'In Stock');

      INSERT INTO Inventory (Store_ID, Product_ID, Stock_Level,
Stock_Status_Date, Stock_Status)

      VALUES (20, 140, 120, TO_DATE('2024-10-10', 'YYYY-MM-DD'), 'Low Stock');

      INSERT INTO Inventory (Store_ID, Product_ID, Stock_Level,
Stock_Status_Date, Stock_Status)
```

```
      VALUES (21, 141, 100, TO_DATE('2024-10-11', 'YYYY-MM-DD'), 'In Stock');

      INSERT INTO Inventory (Store_ID, Product_ID, Stock_Level,
Stock_Status_Date, Stock_Status)

      VALUES (21, 142, 10, TO_DATE('2024-10-12', 'YYYY-MM-DD'), 'Out of
Stock');

      INSERT INTO Inventory (Store_ID, Product_ID, Stock_Level,
Stock_Status_Date, Stock_Status)

      VALUES (22, 143, 80, TO_DATE('2024-10-13', 'YYYY-MM-DD'), 'Low Stock');

      INSERT INTO Inventory (Store_ID, Product_ID, Stock_Level,
Stock_Status_Date, Stock_Status)

      VALUES (22, 144, 90, TO_DATE('2024-10-14', 'YYYY-MM-DD'), 'In Stock');

      INSERT INTO Inventory (Store_ID, Product_ID, Stock_Level,
Stock_Status_Date, Stock_Status)

      VALUES (23, 145, 0, TO_DATE('2024-10-15', 'YYYY-MM-DD'), 'Out of Stock');

      INSERT INTO Inventory (Store_ID, Product_ID, Stock_Level,
Stock_Status_Date, Stock_Status)

      VALUES (23, 146, 150, TO_DATE('2024-10-16', 'YYYY-MM-DD'), 'In Stock');

      INSERT INTO Inventory (Store_ID, Product_ID, Stock_Level,
Stock_Status_Date, Stock_Status)

      VALUES (24, 147, 100, TO_DATE('2024-10-17', 'YYYY-MM-DD'), 'Low Stock');

      INSERT INTO Inventory (Store_ID, Product_ID, Stock_Level,
Stock_Status_Date, Stock_Status)

      VALUES (24, 148, 120, TO_DATE('2024-10-18', 'YYYY-MM-DD'), 'In Stock');

      INSERT INTO Inventory (Store_ID, Product_ID, Stock_Level,
Stock_Status_Date, Stock_Status)

      VALUES (25, 149, 70, TO_DATE('2024-10-19', 'YYYY-MM-DD'), 'Low Stock');

      INSERT INTO Inventory (Store_ID, Product_ID, Stock_Level,
Stock_Status_Date, Stock_Status)

      VALUES (25, 150, 50, TO_DATE('2024-10-20', 'YYYY-MM-DD'), 'Low Stock');

      -- 3. Insert data into Suppliers table

      INSERT INTO Suppliers (Supplier_ID, Product_ID, Lead_Time,
Delivery_History) VALUES (1, 101, 5, 'Delivered on time');

      INSERT INTO Suppliers (Supplier_ID, Product_ID, Lead_Time,
Delivery_History) VALUES (2, 102, 15, 'Delivered late');
```

```
      INSERT INTO Suppliers (Supplier_ID, Product_ID, Lead_Time,
Delivery_History) VALUES (3, 103, 7, 'Delivered on time');

      INSERT INTO Suppliers (Supplier_ID, Product_ID, Lead_Time,
Delivery_History) VALUES (4, 104, 20, 'Delivered late');

      INSERT INTO Suppliers (Supplier_ID, Product_ID, Lead_Time,
Delivery_History) VALUES (5, 105, 3, 'Delivered on time');

      INSERT INTO Suppliers (Supplier_ID, Product_ID, Lead_Time,
Delivery_History) VALUES (6, 106, 6, 'Delivered late');

      INSERT INTO Suppliers (Supplier_ID, Product_ID, Lead_Time,
Delivery_History) VALUES (7, 107, 10, 'Delivered late');

      INSERT INTO Suppliers (Supplier_ID, Product_ID, Lead_Time,
Delivery_History) VALUES (8, 108, 12, 'Delivered on time');

      INSERT INTO Suppliers (Supplier_ID, Product_ID, Lead_Time,
Delivery_History) VALUES (9, 109, 2, 'Delivered on time');

      INSERT INTO Suppliers (Supplier_ID, Product_ID, Lead_Time,
Delivery_History) VALUES (10, 110, 25, 'Delivered late');

      INSERT INTO Suppliers (Supplier_ID, Product_ID, Lead_Time,
Delivery_History) VALUES (11, 111, 4, 'Delivered on time');

      INSERT INTO Suppliers (Supplier_ID, Product_ID, Lead_Time,
Delivery_History) VALUES (12, 112, 18, 'Delivered late');

      INSERT INTO Suppliers (Supplier_ID, Product_ID, Lead_Time,
Delivery_History) VALUES (13, 113, 5, 'Delivered on time');

      INSERT INTO Suppliers (Supplier_ID, Product_ID, Lead_Time,
Delivery_History) VALUES (14, 114, 7, 'Delivered late');

      INSERT INTO Suppliers (Supplier_ID, Product_ID, Lead_Time,
Delivery_History) VALUES (15, 115, 3, 'Delivered on time');

      INSERT INTO Suppliers (Supplier_ID, Product_ID, Lead_Time,
Delivery_History) VALUES (16, 116, 12, 'Delivered late');

      INSERT INTO Suppliers (Supplier_ID, Product_ID, Lead_Time,
Delivery_History) VALUES (17, 117, 10, 'Delivered late');

      INSERT INTO Suppliers (Supplier_ID, Product_ID, Lead_Time,
Delivery_History) VALUES (18, 118, 6, 'Delivered late');

      INSERT INTO Suppliers (Supplier_ID, Product_ID, Lead_Time,
Delivery_History) VALUES (19, 119, 15, 'Delivered late');

      INSERT INTO Suppliers (Supplier_ID, Product_ID, Lead_Time,
Delivery_History) VALUES (20, 120, 4, 'Delivered on time');

      INSERT INTO Suppliers (Supplier_ID, Product_ID, Lead_Time,
Delivery_History) VALUES (21, 121, 8, 'Delivered on time');
```

```
      INSERT INTO Suppliers (Supplier_ID, Product_ID, Lead_Time,
Delivery_History) VALUES (22, 122, 3, 'Delivered on time');

      INSERT INTO Suppliers (Supplier_ID, Product_ID, Lead_Time,
Delivery_History) VALUES (23, 123, 12, 'Delivered late');

      INSERT INTO Suppliers (Supplier_ID, Product_ID, Lead_Time,
Delivery_History) VALUES (24, 124, 6, 'Delivered on time');

      INSERT INTO Suppliers (Supplier_ID, Product_ID, Lead_Time,
Delivery_History) VALUES (25, 125, 9, 'Delivered late');

      INSERT INTO Suppliers (Supplier_ID, Product_ID, Lead_Time,
Delivery_History) VALUES (26, 126, 4, 'Delivered on time');

      INSERT INTO Suppliers (Supplier_ID, Product_ID, Lead_Time,
Delivery_History) VALUES (27, 127, 13, 'Delivered late');

      INSERT INTO Suppliers (Supplier_ID, Product_ID, Lead_Time,
Delivery_History) VALUES (28, 128, 11, 'Delivered on time');

      INSERT INTO Suppliers (Supplier_ID, Product_ID, Lead_Time,
Delivery_History) VALUES (29, 129, 6, 'Delivered on time');

      INSERT INTO Suppliers (Supplier_ID, Product_ID, Lead_Time,
Delivery_History) VALUES (30, 130, 8, 'Delivered late');

      INSERT INTO Suppliers (Supplier_ID, Product_ID, Lead_Time,
Delivery_History) VALUES (31, 131, 5, 'Delivered on time');

      INSERT INTO Suppliers (Supplier_ID, Product_ID, Lead_Time,
Delivery_History) VALUES (32, 132, 9, 'Delivered on time');

      INSERT INTO Suppliers (Supplier_ID, Product_ID, Lead_Time,
Delivery_History) VALUES (33, 133, 7, 'Delivered on time');

      INSERT INTO Suppliers (Supplier_ID, Product_ID, Lead_Time,
Delivery_History) VALUES (34, 134, 11, 'Delivered late');

      INSERT INTO Suppliers (Supplier_ID, Product_ID, Lead_Time,
Delivery_History) VALUES (35, 135, 6, 'Delivered on time');

      INSERT INTO Suppliers (Supplier_ID, Product_ID, Lead_Time,
Delivery_History) VALUES (36, 136, 3, 'Delivered on time');

      INSERT INTO Suppliers (Supplier_ID, Product_ID, Lead_Time,
Delivery_History) VALUES (37, 137, 14, 'Delivered late');

      INSERT INTO Suppliers (Supplier_ID, Product_ID, Lead_Time,
Delivery_History) VALUES (38, 138, 10, 'Delivered on time');

      INSERT INTO Suppliers (Supplier_ID, Product_ID, Lead_Time,
Delivery_History) VALUES (39, 139, 5, 'Delivered on time');

      INSERT INTO Suppliers (Supplier_ID, Product_ID, Lead_Time,
Delivery_History) VALUES (40, 140, 9, 'Delivered late');
```

```
      INSERT INTO Suppliers (Supplier_ID, Product_ID, Lead_Time,
Delivery_History) VALUES (41, 141, 8, 'Delivered on time');

      INSERT INTO Suppliers (Supplier_ID, Product_ID, Lead_Time,
Delivery_History) VALUES (42, 142, 7, 'Delivered late');

      INSERT INTO Suppliers (Supplier_ID, Product_ID, Lead_Time,
Delivery_History) VALUES (43, 143, 6, 'Delivered on time');

      INSERT INTO Suppliers (Supplier_ID, Product_ID, Lead_Time,
Delivery_History) VALUES (44, 144, 12, 'Delivered on time');

      INSERT INTO Suppliers (Supplier_ID, Product_ID, Lead_Time,
Delivery_History) VALUES (45, 145, 5, 'Delivered on time');

      INSERT INTO Suppliers (Supplier_ID, Product_ID, Lead_Time,
Delivery_History) VALUES (46, 146, 8, 'Delivered late');

      INSERT INTO Suppliers (Supplier_ID, Product_ID, Lead_Time,
Delivery_History) VALUES (47, 147, 4, 'Delivered on time');

      INSERT INTO Suppliers (Supplier_ID, Product_ID, Lead_Time,
Delivery_History) VALUES (48, 148, 9, 'Delivered late');

      INSERT INTO Suppliers (Supplier_ID, Product_ID, Lead_Time,
Delivery_History) VALUES (49, 149, 11, 'Delivered on time');

      INSERT INTO Suppliers (Supplier_ID, Product_ID, Lead_Time,
Delivery_History) VALUES (50, 150, 7, 'Delivered late');

      -- 4. Insert data into SalesTransactions table

      INSERT INTO SalesTransactions (Transaction_ID, Product_ID, Store_ID,
Quantity_Sold, Sale_Date)

      VALUES (1001, 101, 1, 50, TO_DATE('2024-10-01', 'YYYY-MM-DD'));

      INSERT INTO SalesTransactions (Transaction_ID, Product_ID, Store_ID,
Quantity_Sold, Sale_Date)

      VALUES (1002, 102, 1, 5, TO_DATE('2024-10-02', 'YYYY-MM-DD'));

      INSERT INTO SalesTransactions (Transaction_ID, Product_ID, Store_ID,
Quantity_Sold, Sale_Date)

      VALUES (1003, 103, 2, 30, TO_DATE('2024-10-03', 'YYYY-MM-DD'));

      INSERT INTO SalesTransactions (Transaction_ID, Product_ID, Store_ID,
Quantity_Sold, Sale_Date)

      VALUES (1004, 104, 2, 0, TO_DATE('2024-10-04', 'YYYY-MM-DD')); --
Stockout

      INSERT INTO SalesTransactions (Transaction_ID, Product_ID, Store_ID,
Quantity_Sold, Sale_Date)
```

```
      VALUES (1005, 105, 3, 100, TO_DATE('2024-10-05', 'YYYY-MM-DD'));

      INSERT INTO SalesTransactions (Transaction_ID, Product_ID, Store_ID,
Quantity_Sold, Sale_Date)

      VALUES (1006, 106, 3, 75, TO_DATE('2024-10-06', 'YYYY-MM-DD'));

      INSERT INTO SalesTransactions (Transaction_ID, Product_ID, Store_ID,
Quantity_Sold, Sale_Date)

      VALUES (1007, 107, 4, 20, TO_DATE('2024-10-07', 'YYYY-MM-DD'));

      INSERT INTO SalesTransactions (Transaction_ID, Product_ID, Store_ID,
Quantity_Sold, Sale_Date)

      VALUES (1008, 108, 4, 0, TO_DATE('2024-10-08', 'YYYY-MM-DD')); --
Stockout

      INSERT INTO SalesTransactions (Transaction_ID, Product_ID, Store_ID,
Quantity_Sold, Sale_Date)

      VALUES (1009, 109, 5, 50, TO_DATE('2024-10-09', 'YYYY-MM-DD'));

      INSERT INTO SalesTransactions (Transaction_ID, Product_ID, Store_ID,
Quantity_Sold, Sale_Date)

      VALUES (1010, 110, 5, 15, TO_DATE('2024-10-10', 'YYYY-MM-DD'));

      INSERT INTO SalesTransactions (Transaction_ID, Product_ID, Store_ID,
Quantity_Sold, Sale_Date)

      VALUES (1011, 111, 6, 45, TO_DATE('2024-10-11', 'YYYY-MM-DD'));

      INSERT INTO SalesTransactions (Transaction_ID, Product_ID, Store_ID,
Quantity_Sold, Sale_Date)

      VALUES (1012, 112, 6, 0, TO_DATE('2024-10-12', 'YYYY-MM-DD')); --
Stockout

      INSERT INTO SalesTransactions (Transaction_ID, Product_ID, Store_ID,
Quantity_Sold, Sale_Date)

      VALUES (1013, 113, 7, 75, TO_DATE('2024-10-13', 'YYYY-MM-DD'));

      INSERT INTO SalesTransactions (Transaction_ID, Product_ID, Store_ID,
Quantity_Sold, Sale_Date)

      VALUES (1014, 114, 7, 35, TO_DATE('2024-10-14', 'YYYY-MM-DD'));

      INSERT INTO SalesTransactions (Transaction_ID, Product_ID, Store_ID,
Quantity_Sold, Sale_Date)

      VALUES (1015, 115, 8, 10, TO_DATE('2024-10-15', 'YYYY-MM-DD'));
```

```
      INSERT INTO SalesTransactions (Transaction_ID, Product_ID, Store_ID,
Quantity_Sold, Sale_Date)

      VALUES (1016, 116, 8, 80, TO_DATE('2024-10-16', 'YYYY-MM-DD'));

      INSERT INTO SalesTransactions (Transaction_ID, Product_ID, Store_ID,
Quantity_Sold, Sale_Date)

      VALUES (1017, 117, 9, 50, TO_DATE('2024-10-17', 'YYYY-MM-DD'));

      INSERT INTO SalesTransactions (Transaction_ID, Product_ID, Store_ID,
Quantity_Sold, Sale_Date)

      VALUES (1018, 118, 9, 15, TO_DATE('2024-10-18', 'YYYY-MM-DD'));

      INSERT INTO SalesTransactions (Transaction_ID, Product_ID, Store_ID,
Quantity_Sold, Sale_Date)

      VALUES (1019, 119, 10, 0, TO_DATE('2024-10-19', 'YYYY-MM-DD')); --
Stockout

      INSERT INTO SalesTransactions (Transaction_ID, Product_ID, Store_ID,
Quantity_Sold, Sale_Date)

      VALUES (1020, 120, 10, 100, TO_DATE('2024-10-20', 'YYYY-MM-DD'));

      INSERT INTO SalesTransactions (Transaction_ID, Product_ID, Store_ID,
Quantity_Sold, Sale_Date)

      VALUES (1021, 121, 11, 25, TO_DATE('2024-10-21', 'YYYY-MM-DD'));

      INSERT INTO SalesTransactions (Transaction_ID, Product_ID, Store_ID,
Quantity_Sold, Sale_Date)

      VALUES (1022, 122, 11, 30, TO_DATE('2024-10-22', 'YYYY-MM-DD'));

      INSERT INTO SalesTransactions (Transaction_ID, Product_ID, Store_ID,
Quantity_Sold, Sale_Date)

      VALUES (1023, 123, 12, 50, TO_DATE('2024-10-23', 'YYYY-MM-DD'));

      INSERT INTO SalesTransactions (Transaction_ID, Product_ID, Store_ID,
Quantity_Sold, Sale_Date)

      VALUES (1024, 124, 12, 15, TO_DATE('2024-10-24', 'YYYY-MM-DD'));

      INSERT INTO SalesTransactions (Transaction_ID, Product_ID, Store_ID,
Quantity_Sold, Sale_Date)

      VALUES (1025, 125, 13, 40, TO_DATE('2024-10-25', 'YYYY-MM-DD'));

      INSERT INTO SalesTransactions (Transaction_ID, Product_ID, Store_ID,
Quantity_Sold, Sale_Date)

      VALUES (1026, 126, 13, 60, TO_DATE('2024-10-26', 'YYYY-MM-DD'));
```

```
      INSERT INTO SalesTransactions (Transaction_ID, Product_ID, Store_ID,
Quantity_Sold, Sale_Date)

      VALUES (1027, 127, 14, 75, TO_DATE('2024-10-27', 'YYYY-MM-DD'));

      INSERT INTO SalesTransactions (Transaction_ID, Product_ID, Store_ID,
Quantity_Sold, Sale_Date)

      VALUES (1028, 128, 14, 10, TO_DATE('2024-10-28', 'YYYY-MM-DD'));

      INSERT INTO SalesTransactions (Transaction_ID, Product_ID, Store_ID,
Quantity_Sold, Sale_Date)

      VALUES (1029, 129, 15, 55, TO_DATE('2024-10-29', 'YYYY-MM-DD'));

      INSERT INTO SalesTransactions (Transaction_ID, Product_ID, Store_ID,
Quantity_Sold, Sale_Date)

      VALUES (1030, 130, 15, 35, TO_DATE('2024-10-30', 'YYYY-MM-DD'));

      INSERT INTO SalesTransactions (Transaction_ID, Product_ID, Store_ID,
Quantity_Sold, Sale_Date)

      VALUES (1031, 131, 16, 20, TO_DATE('2024-10-31', 'YYYY-MM-DD'));

      INSERT INTO SalesTransactions (Transaction_ID, Product_ID, Store_ID,
Quantity_Sold, Sale_Date)

      VALUES (1032, 132, 16, 90, TO_DATE('2024-11-01', 'YYYY-MM-DD'));

      INSERT INTO SalesTransactions (Transaction_ID, Product_ID, Store_ID,
Quantity_Sold, Sale_Date)

      VALUES (1033, 133, 17, 40, TO_DATE('2024-11-02', 'YYYY-MM-DD'));

      INSERT INTO SalesTransactions (Transaction_ID, Product_ID, Store_ID,
Quantity_Sold, Sale_Date)

      VALUES (1034, 134, 17, 50, TO_DATE('2024-11-03', 'YYYY-MM-DD'));

      INSERT INTO SalesTransactions (Transaction_ID, Product_ID, Store_ID,
Quantity_Sold, Sale_Date)

      VALUES (1035, 135, 18, 35, TO_DATE('2024-11-04', 'YYYY-MM-DD'));

      INSERT INTO SalesTransactions (Transaction_ID, Product_ID, Store_ID,
Quantity_Sold, Sale_Date)

      VALUES (1036, 136, 18, 60, TO_DATE('2024-11-05', 'YYYY-MM-DD'));

      INSERT INTO SalesTransactions (Transaction_ID, Product_ID, Store_ID,
Quantity_Sold, Sale_Date)

      VALUES (1037, 137, 19, 50, TO_DATE('2024-11-06', 'YYYY-MM-DD'));
```

```
      INSERT INTO SalesTransactions (Transaction_ID, Product_ID, Store_ID,
Quantity_Sold, Sale_Date)

      VALUES (1038, 138, 19, 15, TO_DATE('2024-11-07', 'YYYY-MM-DD'));

      INSERT INTO SalesTransactions (Transaction_ID, Product_ID, Store_ID,
Quantity_Sold, Sale_Date)

      VALUES (1039, 139, 20, 70, TO_DATE('2024-11-08', 'YYYY-MM-DD'));

      INSERT INTO SalesTransactions (Transaction_ID, Product_ID, Store_ID,
Quantity_Sold, Sale_Date)

      VALUES (1040, 140, 20, 50, TO_DATE('2024-11-09', 'YYYY-MM-DD'));
```

APPENDIX B: CRUD OPERATIONS

The following PL/SQL scripts were developed to facilitate fundamental database interactions within the inventory management system. These operations, Create, Read, Update, and Delete, enable users to manage and manipulate data across key tables such as Products,

Inventory, Sales Transactions, and Suppliers. Each operation is implemented as a PL/SQL procedure or function to streamline database management, ensuring that users can easily add new records, retrieve specific data, modify existing entries, and remove outdated information. The scripts include error handling to maintain data integrity and support efficient, secure access to essential inventory data.

```
-- Insert into Products
CREATE OR REPLACE PROCEDURE insert_product(
    p_product_id INT,
    p_product_name VARCHAR2
) IS
BEGIN
    INSERT INTO Products (Product_ID, Product_Name)
    VALUES (p_product_id, p_product_name);
END;
/
-- Insert into Inventory
CREATE OR REPLACE PROCEDURE insert_inventory(
    p_store_id INT,
    p_product_id INT,
    p_stock_level INT,
    p_stock_status_date DATE,
    p_stock_status VARCHAR2
) IS
BEGIN
    INSERT INTO Inventory (Store_ID, Product_ID, Stock_Level,
Stock_Status_Date, Stock_Status)
    VALUES (p_store_id, p_product_id, p_stock_level, p_stock_status_date,
p_stock_status);
END;
/
-- Insert into Suppliers
CREATE OR REPLACE PROCEDURE insert_supplier(
    p_supplier_id INT,
    p_product_id INT,
    p_lead_time INT,
    p_delivery_history VARCHAR2
) IS
BEGIN
    INSERT INTO Suppliers (Supplier_ID, Product_ID, Lead_Time,
Delivery_History)
    VALUES (p_supplier_id, p_product_id, p_lead_time,
p_delivery_history);
END;
/
-- Insert into SalesTransactions
CREATE OR REPLACE PROCEDURE insert_sales_transaction(
    p_transaction_id INT,
    p_product_id INT,
    p_store_id INT,
    p_quantity_sold INT,
```

```
        p_sale_date DATE
    ) IS
    BEGIN
        INSERT INTO SalesTransactions (Transaction_ID, Product_ID, Store_ID,
Quantity_Sold, Sale_Date)
        VALUES (p_transaction_id, p_product_id, p_store_id, p_quantity_sold,
p_sale_date);
    END;
    /
    -- Read Products
    CREATE OR REPLACE FUNCTION get_product(
        p_product_id INT
    ) RETURN VARCHAR2 IS
        v_product_name VARCHAR2(50);
    BEGIN
        SELECT Product_Name INTO v_product_name
        FROM Products WHERE Product_ID = p_product_id;
        RETURN v_product_name;
    EXCEPTION
        WHEN NO_DATA_FOUND THEN
            RETURN 'No product found';
    END;
    /
    -- Read Inventory
    CREATE OR REPLACE FUNCTION get_inventory(
        p_store_id INT,
        p_product_id INT
    ) RETURN VARCHAR2 IS
        v_stock_status VARCHAR2(20);
    BEGIN
        SELECT Stock_Status INTO v_stock_status
        FROM Inventory WHERE Store_ID = p_store_id AND Product_ID =
p_product_id;
        RETURN v_stock_status;
    EXCEPTION
        WHEN NO_DATA_FOUND THEN
            RETURN 'No inventory found';
    END;
    /
    -- Read Suppliers
    CREATE OR REPLACE FUNCTION get_supplier(
        p_supplier_id INT
    ) RETURN VARCHAR2 IS
        v_delivery_history VARCHAR2(125);
    BEGIN
        SELECT Delivery_History INTO v_delivery_history
        FROM Suppliers WHERE Supplier_ID = p_supplier_id;
        RETURN v_delivery_history;
    EXCEPTION
        WHEN NO_DATA_FOUND THEN
            RETURN 'No supplier found';
    END;
    /
    -- Read SalesTransactions
    CREATE OR REPLACE FUNCTION get_sales_transaction(
        p_transaction_id INT
    ) RETURN VARCHAR2 IS
```

```
        v_sale_info VARCHAR2(200);
    BEGIN
        SELECT 'Product ID: ' || Product_ID || ', Store ID: ' || Store_ID ||
', Quantity Sold: ' || Quantity_Sold || ', Sale Date: ' || Sale_Date
        INTO v_sale_info
        FROM SalesTransactions WHERE Transaction_ID = p_transaction_id;
        RETURN v_sale_info;
    EXCEPTION
        WHEN NO_DATA_FOUND THEN
            RETURN 'No transaction found';
    END;
    /
    -- Update Products
    CREATE OR REPLACE PROCEDURE update_product(
        p_product_id INT,
        p_product_name VARCHAR2
    ) IS
    BEGIN
        UPDATE Products
        SET Product_Name = p_product_name
        WHERE Product_ID = p_product_id;
    END;
    /
    -- Update Inventory
    CREATE OR REPLACE PROCEDURE update_inventory(
        p_store_id INT,
        p_product_id INT,
        p_stock_level INT,
        p_stock_status VARCHAR2
    ) IS
    BEGIN
        UPDATE Inventory
        SET Stock_Level = p_stock_level, Stock_Status = p_stock_status
        WHERE Store_ID = p_store_id AND Product_ID = p_product_id;
    END;
    /
    -- Update Suppliers
    CREATE OR REPLACE PROCEDURE update_supplier(
        p_supplier_id INT,
        p_lead_time INT,
        p_delivery_history VARCHAR2
    ) IS
    BEGIN
        UPDATE Suppliers
        SET Lead_Time = p_lead_time, Delivery_History = p_delivery_history
        WHERE Supplier_ID = p_supplier_id;
    END;
    /

    -- Update SalesTransactions
    CREATE OR REPLACE PROCEDURE update_sales_transaction(
        p_transaction_id INT,
        p_quantity_sold INT,
        p_sale_date DATE
    ) IS
    BEGIN
        UPDATE SalesTransactions
```

```
        SET Quantity_Sold = p_quantity_sold, Sale_Date = p_sale_date
        WHERE Transaction_ID = p_transaction_id;
    END;
    /
    -- Delete from Products
    CREATE OR REPLACE PROCEDURE delete_product(
        p_product_id INT
    ) IS
    BEGIN
        DELETE FROM Products WHERE Product_ID = p_product_id;
    END;
    /
    -- Delete from Inventory
    CREATE OR REPLACE PROCEDURE delete_inventory(
        p_store_id INT,
        p_product_id INT
    ) IS
    BEGIN
        DELETE FROM Inventory WHERE Store_ID = p_store_id AND Product_ID =
p_product_id;
    END;
    /
    -- Delete from Suppliers
    CREATE OR REPLACE PROCEDURE delete_supplier(
        p_supplier_id INT
    ) IS
    BEGIN
        DELETE FROM Suppliers WHERE Supplier_ID = p_supplier_id;
    END;
    /
    -- Delete from SalesTransactions
    CREATE OR REPLACE PROCEDURE delete_sales_transaction(
        p_transaction_id INT
    ) IS
    BEGIN
        DELETE FROM SalesTransactions WHERE Transaction_ID =
p_transaction_id;
    END;
    /
```

APPENDIX C: PL/SQL CODE IMPLEMENTATION TO ANSWER QUERIES

The Appendix provides the complete PL/SQL code for each operation and procedure discussed in the report. These scripts include the SQL queries, methods, and functions that

address the ten key questions, allowing users to understand and replicate the functionality designed to improve Walmart's inventory management system.

```
/*Patterns in Product Demand Across Regions and Seasons: Aggregate sales data by region and season to identify demand patterns.*/
SELECT Store_ID, EXTRACT(MONTH FROM Sale_Date) AS Month,
SUM(Quantity_Sold) AS Total_Sold
FROM SalesTransactions
GROUP BY Store_ID, EXTRACT(MONTH FROM Sale_Date)
ORDER BY Store_ID, Month;
/*Predict Stock Shortages Before They Occur: Implement a procedure to check stock levels and compare them with historical average sales. If stock is below a threshold, trigger a reorder.*/
CREATE OR REPLACE PROCEDURE predict_stock_shortage(p_product_id IN NUMBER,
p_store_id IN NUMBER) IS
       v_avg_sales NUMBER;
       v_stock_level NUMBER;
   BEGIN
       -- Calculate average monthly sales for the product
       SELECT AVG(Quantity_Sold) INTO v_avg_sales
       FROM SalesTransactions
       WHERE Product_ID = p_product_id AND Store_ID = p_store_id;
       -- Check current stock level
       SELECT Stock_Level INTO v_stock_level
       FROM Inventory
       WHERE Product_ID = p_product_id AND Store_ID = p_store_id;
       -- Output message if stock level is below the average monthly sales
       IF v_stock_level < v_avg_sales THEN
           DBMS_OUTPUT.PUT_LINE('Stock level is low. Consider reordering.');
```

```
        END IF;
    END;
    /
/*Factors Contributing to Overstock Situations: Identify products with low
sales but high stock levels to locate overstock.*/
 SELECT i.Product_ID, i.Store_ID, i.Stock_Level,
COALESCE(SUM(st.Quantity_Sold), 0) AS Total_Sold
    FROM Inventory i
    LEFT JOIN SalesTransactions st ON i.Product_ID = st.Product_ID AND
i.Store_ID = st.Store_ID
    GROUP BY i.Product_ID, i.Store_ID, i.Stock_Level
    HAVING i.Stock_Level > 1.5 * COALESCE(SUM(st.Quantity_Sold), 1);
/*Optimize Reorder Points for Product Categories: Calculate average lead times
from suppliers and use historical sales to determine reorder points.*/
SELECT Product_ID, AVG(Lead_Time) AS Avg_Lead_Time,
AVG(Quantity_Sold) * AVG(Lead_Time) AS Reorder_Point
FROM SalesTransactions st
JOIN Suppliers s ON st.Product_ID = s.Product_ID
    GROUP BY Product_ID;
/*Impact of Inaccurate Inventory Data on Sales Performance: Query to identify
cases where a sale could not be completed due to low or inaccurate stock
levels.*/
SELECT st.Transaction_ID, st.Product_ID, st.Store_ID,
st.Quantity_Sold, i.Stock_Level
FROM SalesTransactions st
JOIN Inventory i ON st.Product_ID = i.Product_ID AND st.Store_ID
= i.Store_ID
WHERE i.Stock_Level < st.Quantity_Sold;
```

```
/*Improve Supplier Lead Time Estimates: Calculate the lead time average for
each supplier based on historical deliveries.*/
SELECT Supplier_ID, Product_ID, AVG(Lead_Time) AS Avg_Lead_Time
FROM Suppliers
GROUP BY Supplier_ID, Product_ID;
/*Products with Highest Return Rates and Their Impact on Inventory: Track
return rates and identify products with high return rates.*/
   SELECT Product_ID, COUNT(*) AS Return_Count
   FROM SalesTransactions
   WHERE Quantity_Sold < 0
   GROUP BY Product_ID
   ORDER BY Return_Count DESC;
/*Reduce Time to Restock Shelves After Sell-Outs: Identify products with low
stock and flag for immediate restocking based on supplier lead times.*/
   CREATE OR REPLACE PROCEDURE restock_recommendation(p_product_id IN NUMBER,
p_store_id IN NUMBER) IS
       v_lead_time NUMBER;
       v_stock_level NUMBER;
   BEGIN
       -- Fetch supplier lead time for product
       SELECT AVG(Lead_Time) INTO v_lead_time
       FROM Suppliers
       WHERE Product_ID = p_product_id;
       -- Get current stock level
       SELECT Stock_Level INTO v_stock_level
       FROM Inventory
       WHERE Product_ID = p_product_id AND Store_ID = p_store_id;
       IF v_stock_level = 0 THEN
```

```
            DBMS_OUTPUT.PUT_LINE('Restock recommended for Product ' ||
p_product_id || ' at Store ' || p_store_id);
        END IF;
    END;
    /
/*Identify Slow-Moving Items and Adjust Stock Levels: Query to find products
with minimal sales over a given period.*/
    SELECT Product_ID, Store_ID, SUM(Quantity_Sold) AS Total_Sold
    FROM SalesTransactions
    WHERE Sale_Date > ADD_MONTHS(SYSDATE, -6)
    GROUP BY Product_ID, Store_ID
    HAVING SUM(Quantity_Sold) < 10;
/*Impact of Return Rates on Inventory Management: Calculate the percentage of
returns relative to total sales for each product.*/
    SELECT Product_ID,
           SUM(CASE WHEN Quantity_Sold < 0 THEN ABS(Quantity_Sold) ELSE 0 END) /
SUM(ABS(Quantity_Sold)) * 100 AS Return_Rate
    FROM SalesTransactions
    GROUP BY Product_ID
    HAVING Return_Rate > 5;
```

APPENDIX D: TRIGGERS

Triggers are essential components in database management systems, designed to execute predefined actions automatically when specific events occur. In the Inventory Management Solution, triggers play a crucial role in ensuring the integrity and accuracy of stock-related operations. This appendix outlines the triggers implemented in the database, including their purpose and functionality. The triggers ensure sufficient stock levels before sales transactions and update supplier delivery history, automating critical tasks and maintaining data consistency.

```
/*
This trigger checks that the stock level is sufficient before a sale proceeds.
If the stock level is too low, an error is raised.
*/
CREATE OR REPLACE TRIGGER trg_check_stock_level BEFORE
    INSERT ON salestransactions
    FOR EACH ROW
DECLARE
    insufficient_stock EXCEPTION;
    stock_level NUMBER;
BEGIN
    -- Retrieve stock level for the product
    SELECT stock_level
    INTO stock_level
    FROM inventory
    WHERE product_id = :new.product_id AND store_id = :new.store_id;

    -- Check if stock is insufficient
    IF :new.quantity_sold > stock_level THEN
        RAISE insufficient_stock;
```

```
    END IF;
EXCEPTION
    WHEN insufficient_stock THEN
        raise_application_error(-20001, 'Insufficient stock for this
transaction.');
END;
/
/*
This trigger updates the Delivery_History in the Suppliers table every time
there’s a new inventory entry from a supplier.
*/
   CREATE OR REPLACE TRIGGER trg_supplier_delivery
   AFTER INSERT ON Inventory
   FOR EACH ROW
   BEGIN
       UPDATE Suppliers
       SET Delivery_History = Delivery_History || ', Delivered on ' ||
TO_CHAR(SYSDATE, 'YYYY-MM-DD')
       WHERE Supplier_ID = (SELECT Supplier_ID FROM Suppliers WHERE Product_ID
= :NEW.Product_ID);
   END;
   /
```

APPENDIX E: CONSTRAINTS

Constraints are rules enforced on database tables to maintain data integrity and consistency. They help ensure that data adheres to the defined schema and business logic. In the Inventory Management Solution, constraints are used to validate critical aspects of the system, such as maintaining positive sales quantities, ensuring non-negative stock levels, and upholding the relationships between products, inventory, and suppliers. This appendix documents the constraints implemented in the database and explains how they contribute to robust inventory management.

```
/* Ensures that each sale has a positive quantity */
ALTER TABLE SalesTransactions
   ADD CONSTRAINT chk_positive_quantity_sold CHECK (Quantity_Sold > 0);
/* Ensures each entry in the `Inventory` table references a valid product.*/
   ALTER TABLE Inventory
   ADD CONSTRAINT fk_inventory_product FOREIGN KEY (Product_ID)
   REFERENCES Products (Product_ID);
/*Ensures that each supplier's product is valid in the `Products` table.*/
ALTER TABLE Suppliers
ADD CONSTRAINT fk_supplier_product FOREIGN KEY (Product_ID)
 REFERENCES Products (Product_ID);
/*Ensures that stock levels are never negative.*/
ALTER TABLE Inventory
   ADD CONSTRAINT chk_stock_level_non_negative CHECK (Stock_Level >= 0);
/*Ensures each product appears only once per store.*/
 ALTER TABLE Inventory
   ADD CONSTRAINT uq_product_store UNIQUE (Product_ID, Store_ID);
```