***1. Theoretical Questions***

*Relational Database*

A relational database organizes data into tables with rows and columns, where each table represents an entity, and rows represent individual records. Primary keys uniquely identify records, establishing relationships between tables for efficient data organization, integrity, and minimal redundancy.

*CRUD Flow*

CRUD (Create, Read, Update, Delete) forms the foundational operations in database management. It defines the sequence of actions: creating new records, reading data, updating existing records, and deleting records.

*Joins in SQL*

* Inner Join: Combines rows with matching values from multiple tables.
* Left Join: Retrieves all records from the left table and matching records from the right table, filling unmatched columns with null values. Useful for inclusive retrieval.

*Indexing in SQL*

Indexing involves creating structures on table columns to expedite data retrieval, reducing the scanned data amount. This improves query performance, especially with large datasets.

*View in SQL*

A view is a virtual table based on a SELECT query's result. It simplifies complex queries, encapsulates business logic, and controls data access by presenting only necessary information.

*Stored Procedure in SQL*

A stored procedure is a precompiled set of one or more SQL statements stored on the database server. It enhances code modularity, reusability, and performance, often used for complex operations, transaction management, and security.

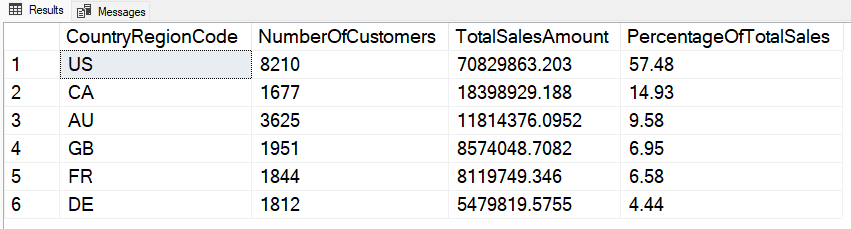
***2. Overview of the AdventureWorks2022 database:***

The AdventureWorks2022 database serves as a comprehensive simulation of real-world business operations, organized into multiple interlinked schemas that cover different aspects of a company's activities.

|  |  |
| --- | --- |
| Schema | Description |
| dbo Schema | Contains system-related tables |
| Human Resources Schema | Manages employee-related data |
| Person Schema | Individual entities associated with the business |
| Production Schema | Central to the manufacturing aspect of the business |
| Purchasing Schema | Related to procurement |
| Sales Schema | Sales operations details |

The following tables offer a concise overview of various aspects of a company's operations:

Customers by Demographics



Yearly Revenue

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Employees Performances:

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Total Inventory Value by Category

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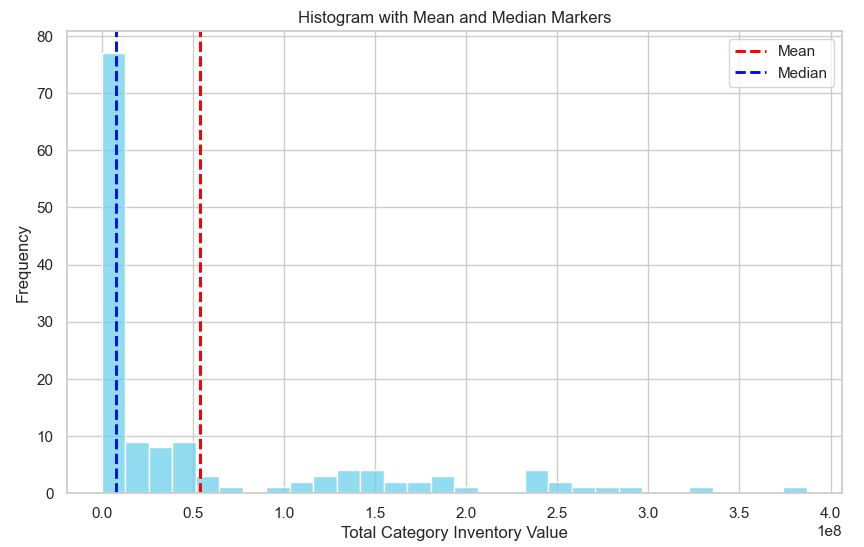
***3. Perform statistical analysis:***

Examining the inventory segment through a detailed statistical analysis allows us to gain a better understanding of the inventory dynamics by category.

* Mean Inventory Value: $53,964,146.23
* Confidence Interval (95.0%): [$40,000,919.84, $67,927,372.62]
* Standard Deviation of Inventory: $83,262,121.14
* Median Inventory Value: $7,808,060.26

***3.1. Interpretation****:*

The mean inventory value is approximately $53.96 million, with a 95% confidence interval between $40.00 million and $67.93 million. The substantial standard deviation of $83.26 million indicates considerable variability. Furthermore, the right-skewed distribution, as evidenced by a median inventory value of $7.81 million, suggests (outliers: product/category) with exceptionally high values. Identifying and managing these outliers becomes crucial for efficient inventory management.



***4. Analysis of data and results:***

The dataset encompasses detailed information on four distinct product categories: Bikes, Components, Clothing, and Accessories. It provides insights into the inventory dynamics and order statistics from 2011 to 2014.

* The Bikes category consistently holds a dominant position in both inventory and inventory value. Notably, a peak is observed in March 2014, where the inventory reaches 445,433 units, and the inventory value totals $ 386,830,991.8.
* The inventory value for the Bikes category is significantly higher than other categories, influencing the overall mean.
* A graph of a number of different colored lines

  Description automatically generatedExcluding the Bikes category results in a substantial reduction in the overall mean inventory value, reflecting the impact of Bikes' disproportionately large values as we can see in the charts below:

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*4.1.* ***Recommendations:***

* Strategic Pricing and Marketing:

Review and adjust pricing and marketing strategies for products with low stock value to stimulate demand and increase visibility.

* Supply Chain Alignment:

Align supply chain practices for high-turnover products to ensure optimal stock levels and minimize holding costs.

* Data-driven decision-making:

Implement data-driven decision-making processes for adaptive strategies and explore potential adjustments in inventory levels within each category based on demand patterns and product performance to enhance overall business efficiency.

***5. Executive summary***

After Analyzing the AdventureWorks2022 Database, Here Are the Key Findings:

*1. Sales Performance Insights:*

Unveiling the top-performing products, we identified that "Mountain Bike”, and "Road Helmet" significantly fueled the company's robust sales performance, steering yearly revenue trends.

*2. Employee Contribution Metrics:*

Identifying key contributors, employees like Linda Mitchell and Jillian Carson emerged as top performers, each securing sales amounts exceeding $11 million.

*3. Market Distribution Impact:*

Analyzing customer demographics showcased the dominance of the U.S., contributing 57.48% of total sales, followed by Canada, Australia, and the United Kingdom.

1. *Inventory Dynamics Breakdown:*

Exploring total inventory value by category, the Bikes category stood out with 14,536 units and a value exceeding $14.6 million.

1. *Statistical Analysis:*

The mean inventory stands at $53,964,146.23, with a $7.81 million median signaling a right-skewed distribution, highlighting specific high-value products/categories.

1. *Bikes Category Dominance:*

The consistent dominance of the Bikes category significantly influenced the overall mean inventory value and shaped inventory dynamics.

1. *Outlier Identification:*

Excluding the Bikes category led to a noteworthy reduction in the mean inventory value, emphasizing the impact of outliers and prompting targeted inventory management.

1. *Strategic Pricing Impact:*

Recommendations for strategic pricing adjustments extend to high-performing products like "Mountain Bike" and "Road Helmet," aiming to stimulate demand and enhance market visibility.

1. *Supply Chain Optimization Strategies*:

Aligning supply chain practices, especially for high-turnover products like Bikes, becomes critical for maintaining optimal stock levels and minimizing holding costs.

1. *Data-Driven Decision-making Emphasis:*

Emphasizing data-driven decision-making processes is crucial for adaptive strategies, considering product performance and demand patterns to enhance overall business efficiency.

***Recommendations:***

In conclusion, leveraging insights from top-performing products, employee contributions, and market distribution, we propose strategic adjustments in pricing, supply chain practices, and data-driven decision-making.