**Relational Database Design for Ecomart Report**

**Part 1: Design Document**

**A1. Business Problem**

EcoMart, an eco-conscious online marketplace, faces challenges in managing and analyzing its data effectively (Elmasri & Navathe, 2016; United Nations, 2015). As the platform grows, the company struggles to:

* Track product sales and revenue efficiently across different regions.
* Identify high-performing eco-friendly products based on sustainability certifications.
* Analyze customer reviews to assess product performance and improve satisfaction.
* Maintain scalability to handle increasing data volumes and user traffic.

A well-designed relational database can centralize data, enable advanced querying, and support informed decision-making to address these challenges.

**A2. Data Structure**

The proposed relational database structure includes the following key tables (PostgreSQL Global Development Group, n.d.):

1. **Products Table**:
   * Captures product details, including sustainability certifications and eco-impact ratings.
2. **Orders Table**:
   * Tracks sales information, such as order IDs, regions, quantities sold, and revenue.
3. **Reviews Table**:
   * Stores user feedback to analyze sentiment and improve product offerings.

**Relationships**:

* Each product can appear in multiple orders (one-to-many relationship between Products and Orders).
* Each product can have multiple reviews (one-to-many relationship between Products and Reviews).

**A3. Database Justification**

A relational database offers:

* Data Organization: Centralizes product, sales, and review data in structured tables, making it easier to manage and retrieve.
* Advanced Querying: Enables complex queries to analyze trends, track revenue, and assess customer feedback (Elmasri & Navathe, 2016).
* Scalability: Supports increasing data volumes with indexing, partitioning, and optimization techniques (Stonebraker & Hellerstein, 2005).
* Integration: Allows seamless integration with business analytics tools for real-time insights and reporting.

**A4. Data Usage**

The database will support the following use cases (Pang & Lee, 2008; Elmasri & Navathe, 2016):

1. Product Performance Analysis:
   * Identify top-selling products in specific regions.
   * Compare sales trends across categories (Elmasri & Navathe, 2016; PostgreSQL Global Development Group, n.d.).
2. Customer Feedback Assessment:
   * Analyze reviews to determine customer satisfaction.
   * Identify products requiring improvement (Pang & Lee, 2008).
3. Sustainability Reporting:
   * Generate reports on eco-friendly product performance based on sustainability certifications and ratings.
4. Decision Support:
   * Inform inventory management and marketing strategies based on data insights.

**B. Logical data model for storing data in the database solution**

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**C. Description of Database Objects and Storage with File Attributes**

Database Objects:

1. Tables:
   * Products: Stores product details.
   * Orders: Tracks sales data.
   * Reviews: Holds customer feedback.
2. Indexes:
   * Created on frequently queried fields (Product\_ID, Region) to optimize performance.
3. Foreign Keys:
   * Ensure relational integrity between Products, Orders, and Reviews.

File Attributes:

1. Products:
   * Product\_Name (String): Maximum length of 255 characters.
   * Category (String): Maximum length of 100 characters.
   * Sustainability\_Certification (String): Maximum length of 100 characters.
   * Eco\_Impact\_Rating (Integer): Range 1–5.
2. Orders:
   * Region (String): Maximum length of 100 characters.
   * Units\_Sold (Integer): Positive values only.
   * Revenue (Decimal): Two decimal places for monetary values.
3. Reviews:
   * Rating (Integer): Range 1–5.
   * Review\_Text (Text): Unlimited length.

**D. Scalability Strategies**

Normalization:

* The database is normalized to 3NF (Third Normal Form), reducing redundancy and improving data consistency (Stonebraker & Hellerstein, 2005).

Indexing:

* Frequently queried fields (Product\_ID, Region) are indexed to enhance query performance (PostgreSQL Global Development Group, n.d.).

Partitioning:

* Large tables like Orders can be partitioned by region or date for efficient parallel processing.

Horizontal and Vertical Scaling:

* Supports horizontal scaling (distributing data across servers) and vertical scaling (adding resources to the database server).

Caching:

* Frequently accessed data, such as top-selling products, can be cached for quicker retrieval.

**E. Privacy and Security Measures**

**Data Privacy:**

1. Encryption:
   * Encrypt sensitive fields (e.g., review text) to protect user data.
   * Use SSL/TLS for secure communication between clients and the database.
2. Anonymization:
   * Replace user-identifiable information (e.g., User\_ID) with anonymized IDs.

Access Control:

1. Role-Based Permissions:
   * Grant access to tables and queries based on user roles (e.g., admin, analyst) (PostgreSQL Global Development Group, n.d.).
2. Least Privilege Principle:
   * Limit user access to only the data they need.

Security Measures:

1. Auditing and Logging:
   * Maintain logs of database changes to track unauthorized access or modifications.
2. Authentication:
   * Enforce strong password policies and multi-factor authentication for admin accounts.

Backup and Recovery:

1. Automated Backups:
   * Schedule regular backups of the database.
2. Disaster Recovery:
   * Implement failover servers for high availability in case of system failure.

**Part 2: Implementation**

**F1. Create a Database Instance**

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**F2. Create tables & Import Data**

A. Create Tables

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B. Import Data into the Sales Records Table

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C. Populate Products, Orders, and Reviews Tables

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F3. Write Queries for Business Insights

Query 1: Top-Selling Products by Region

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Query 2: Eco-Friendly Products with High Sales

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Query 3: Top-Rated Products

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F4.) Optimization of Scripts and Data Validation

a. Optimization Scripts

Pre-indexing

Query 1

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Query 2

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Query 3

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Indexing

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Post-indexing

Query 1

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Query 2

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Query 3

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b. Final Data Validation

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References

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