LibraryDB – Database Documentation

1. System Description / Domain

LibraryDB represents a **library management system**, tracking **books, authors, customers, librarians, borrowing activities, and transactions**.

User Roles:

- **Librarians** – manage books and record borrow/return operations
- **Customers** – borrow and return books

System handles:

- Book catalog and genres
- Author and customer details
- Borrowing transactions and late fees
- Reports (top borrowed books, customer activity, birthdays, etc.)

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2. Database Overview

Sl	Table	Purpose
1	`Countries`	List of countries
2	`Regions`	Regions linked to countries
3	`Cities`	Cities linked to regions
4	`Authors`	Author basic information
5	`AuthorDetails`	Email, DOB, country of authors
6	`Genres`	Book genres
7	`Books`	Catalog with quantity, author, and genre
8	`Librarians`	Librarian names

9	`LibrarianDetails`	Contact info and city
10	`Customers`	Customer names
11	`CustomerDetails`	Contact info and city
12	`Borrow`	Borrow records linking books, customers, librarians
13	`Transactions`	Late fee records

Primary Keys: `BookId`, `CustomerId etc.`
Foreign Keys: Ensure referential integrity (e.g., `Books.AuthorId → Authors.AuthorId`)

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3. Relationships

One-to-One (1:1):
- Author = AuthorDetails
- Librarian = LibrarianDetails
- Customer = CustomerDetails

One-to-Many (1:M):
- Country -> Regions -> Cities
- Author -> Books
- Customer -> Borrows

Many-to-Many (M:N):
- Customers <-> Books (via Borrow table)

Motivation:

- Avoid data duplication
- Easier updates & future scalability
- Clear structure for queries and reporting

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4. Normalization

Database follows **3NF**:

- ➢ Each field stores **one simple value**.
- ➢ All data in a table is related to its **main ID (primary key)**.
- ➢ No field depends on another field.
- ➢ Some **views** may repeat data only to make **reports easier to read**.

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5. Key Features / Functions

- **Stored Procedures:** `Retrun_Book`, `Retrun_Book_All` for book returns and late fees
- **Views:**
  - ➢ `vw_BorrowingInformation` – detailed borrow info
  - ➢ `vw_TopBorrowedBook` – top borrowed books
- **Functions:** Calculate age, DOB, full address, country name
- **Triggers:** Maintain book quantity automatically
- **Queries:**
  - ➢ Limit & Offset for paging
  - ➢ Aggregate functions (SUM, COUNT)
  - ➢ HAVING for filtered groups
  - ➢ Joins across 3+ tables
  - ➢ CASE statements
  - ➢ LIKE for free-text search

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6. Indexing

- `Books.BookName` indexed for faster search

Motivation: Speeds up queries on frequently searched columns

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7. Data Types

- `INT` – IDs, quantities
- `VARCHAR` – Names, emails, phone numbers
- `DATE` – DOB, BorrowDate, ReturnDate
- `DECIMAL` – Transaction amounts

Reasoning: We choose data types that match the data so the database is simple and works faster.

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8. Security & Integrity

- **NOT NULL** ensures mandatory fields
- **UNIQUE** prevents duplicate emails/person numbers
- **Foreign Keys** enforce relationships
- Triggers maintain book stock consistency

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9. Sample Reports / Queries

- Top 3 borrowed books per month
- Customers with late fees this month
- Birthday greetings for customers
- Books never borrowed
- Customer reading preferences

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10. Conclusion

LibraryDB is a simple and well-organized library system. It helps manage daily work like borrowing books, making reports, and keeping data correct.The database keeps different data in separate tables, links them properly, and makes it easy and fast to get information.