AIR UNIVERSITY

AIR University

LIBRARY MANAGEMENT SYSTEM

Semester Project

Department of Computer Science

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1. Project Overview

The Library Management System is a relational database project designed to help manage different Records of a Library. It covers everything from keeping Book records such as Author, Publisher, Inventory to Member Records, Reservations, Loans, Fines, and Book Reviews. The system is designed to make sure data is stored efficiently, stays consistent, and can be easily retrieved when needed.

2. Schema Design Decisions

The design of the Library Management System schema was guided by the following objectives:

- Represent the core operations of a library, including borrowing, returning, reserving books, and managing users and staff.
- Ensure data integrity using proper normalization (up to 3NF).
- Allow tracking of individual book copies across multiple branches.

Key Design Decisions:

- Real-life entities such as **Book, Author, Publisher, Member, Staff** and **Branch** were used as you would find in a real-life Library.
- Other than that, I introduced an **Inventory** table to track physical copies of books at different branches.
- To model the many-to-many relationship between **Book** and **Author**, I used a junction table **BookAuthor**.
- Used Additional entities for **Loan, Fine, Reservation**, and **Review** to capture user interactions with books.
- Kept **Genre** and **Publisher** as separate entities. This helps with better categorization and lookup flexibility.

Normalization:

- The schema is kept in Third Normal Form (3NF). That means every table has no unnecessary duplication, and all data is related to the key and nothing else.

EERD Features:

- Used **Generalization** to group Member and **Staff** entities under **Person.**

3. Entity-Attribute Relationships

Person:

- Key Attributes include PersonID, FirstName, LastName, Email, Phone
- Is a Base Type

Member:

- Is a Sub Type of Person
- Key Attributes include MembershipType

Staff:

- Is a Sub Type of Person
- Key Attributes include HireDate and Role

Book:

- Stores books' core metadata
- Key Attributes include BookID, Title, ISBN, YearPublished

Author:

- Stores Info about Authors
- Key Attributes include AuthorID, FirstName, LastName, Bio

BookAuthor:

- Connect Book and Author through M:N relationship
- Key Attributes include BookID, AuthorID

Inventory:

- Tracks each copy of a book
- Key Attributes include InventoryID, BookID, BranchID, CopyNumber

Loan:

- Tracks lending of book copies
- Key Attributes include LoanID, InventoryID, MemberID, StaffID

Fine:

- Stores Penalties for late returns
- Key Attributes include FineID, LoanID, Amount, PaidDate

Reservation:

- Stores reservations placed on book copies
- Key Attributes include ReservationID, InventoryID, MemberID

Review:

- Stores Member feedback on books
- Key Attributes include ReviewID, BookID, MemberID, Rating

Branch:

- Physical locations of the library
- Key Attributes include BranchID, Name, Location

Genre:

- Book categories
- Key Attributes include GenreID, Name, Description

Publisher:

- Book publishers
- Key Attributes include PublisherID, Name, Address, Phone

Realtionships:

- A Book can have many Authors and vice versa → via BookAuthor
- A Book has one Genre and one Publisher
- An Inventory record refers to a Book Copy and a Branch
- A Member can borrow (Loan) or reserve (Reservation) multiple books
- A Staff can issue Loan
- A Publisher can publish many Books
- A Loan can incur one Fine
- A Member can write multiple Reviews

4. Assumptions Made

- Each Book record represents a unique title, not individual copies.
- Physical copies are tracked separately via the Inventory table.
- A Person can either be a Member or a Staff but not both.
- Every Loan is associated with a Staff who processes it.
- Each book copy can be loaned or reserved by one Member at a time.
- Fine is only generated for late Loan returns.
- Ratings in Review are assumed to be on a scale of 1 to 5.
- Status in Inventory can either be ‘Available’ or ‘Loaned’ and nothing else.
- MembershipType in Member can either be ‘Regular’ or ‘Premium’ and nothing else.
- CopyNumber in Inventory is unique per BookID + BranchID.
- The system does not allow overlapping reservations on the same copy.
- Each branch operates independently with its own book stock.
- If a book record is deleted, everything associated with that Book record is also going to be deleted as well. This includes Inventory in all Branches, loan and Reservation.