**📚 Project 5: Library Management System**

**1. Introduction**

The **Library Management System** is a structured relational database project designed to manage and automate the operations of a library. This includes keeping track of books, authors, registered members, and the lending process. The goal is to enhance efficiency, reduce human error, and simplify day-to-day library management through the use of a database.

**2. Objectives**

* To store and manage data related to books and their authors.
* To keep a record of members registered in the library.
* To manage and track the issuance and return of books.
* To prevent data redundancy and ensure data consistency.
* To simplify complex queries using a relational database design.
* To support data retrieval for reporting purposes.

**3. Database Design**

The Library Management System consists of the following five main entities:

1. **Authors** – Contains information about book authors.
2. **Books** – Stores book information such as title, genre, and year of publication.
3. **BookAuthors** – A junction table representing a many-to-many relationship between books and authors.
4. **Members** – Contains data about users/members of the library.
5. **Loans** – Manages the lending and returning of books to/from members.

**4. Table Descriptions**

**Authors**

* author\_id – INT, Primary Key
* name – VARCHAR(100)
* birth\_year – INT

**Books**

* book\_id – INT, Primary Key
* title – VARCHAR(200)
* genre – VARCHAR(100)
* published\_year – YEAR

**BookAuthors**

* book\_id – INT, Foreign Key → Books
* author\_id – INT, Foreign Key → Authors  
  (*Composite key of book\_id and author\_id*)

**Members**

* member\_id – INT, Primary Key
* name – VARCHAR(100)
* join\_date – DATE
* email – VARCHAR(100)

**Loans**

* loan\_id – INT, Primary Key
* book\_id – INT, Foreign Key → Books
* member\_id – INT, Foreign Key → Members
* loan\_date – DATE
* due\_date – DATE
* return\_date – DATE (can be NULL if not yet returned)

**5. Sample SQL Queries**

**🔍 View all books with their authors**

SELECT B.title, A.name AS author\_name

FROM Books B

JOIN BookAuthors BA ON B.book\_id = BA.book\_id

JOIN Authors A ON A.author\_id = BA.author\_id;

**📅 List of overdue books**

SELECT L.loan\_id, M.name AS member\_name, B.title, L.due\_date

FROM Loans L

JOIN Members M ON L.member\_id = M.member\_id

JOIN Books B ON L.book\_id = B.book\_id

WHERE L.return\_date IS NULL AND L.due\_date < CURDATE();

**📚 Books currently on loan**

SELECT B.title, M.name AS borrower, L.loan\_date, L.due\_date

FROM Loans L

JOIN Books B ON L.book\_id = B.book\_id

JOIN Members M ON L.member\_id = M.member\_id

WHERE L.return\_date IS NULL;

**6. Benefits of the System**

* Reduces manual errors by using foreign key constraints and relationships.
* Simplifies tracking of overdue books and borrowing history.
* Allows librarians to maintain up-to-date information on books and members.
* Makes data retrieval easy for reports and analysis.
* Can be extended to include notifications, fines, digital resources, etc.

**7. Conclusion**

The Library Management System is a comprehensive solution for managing the daily activities of a library. It efficiently handles book records, member registration, and lending/return operations using a well-structured relational database. Its normalized schema ensures integrity, flexibility, and performance, making it ideal for both academic and public library environments.