DATA BASE PROJECT

LIBRARY MANAGEMENT SYSTEM

by Renad

MAY

MONDAY 12 AT 6 PM

2025

Requirements

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SYSTEM'S PURPOSE AND USERS

THE SYSTEM IS DESIGNED TO MANAGE A LIBRARY BY:

Tracking books and their details (title, authors, genres)

Managing members (names, membership status)

Recording detailed borrowing transactions (including borrow date, return date, and supervising librarian)

Managing librarians who supervise borrowing operations

Allowing the admin to Manage books

THE USERS:

- **Admin**: Responsible for managing (adding, updating, deleting) books.
- Each book is assigned to an admin .

- **Member:** Can borrow books .
- Each borrowing record is linked to one member

- **Librarian:** Supervises borrowing transactions .
- Each borrowing record is assigned to one librarian

key entities (tables) and their attributes (columns):

Admin:

id (Primary Key)

name (composite to: first, last)

information

key entities (tables) and their attributes (columns):

BOOK:

id (Primary Key)
title

author(multi-valued – needs a separate table)

admin_id (Foreign Key – refers to the admin who manages the book)

genre_id (Foreign Key – refers to the book's genre)

key entities (tables) and their attributes (columns):

GENRES:

id (Primary Key)

name

key entities (tables) and their attributes (columns):

MEMBER:

id (Primary Key)

name (composite to: first, last)

membership_status

admin_id (Foreign Key – refers to the admin managing the member)

key entities (tables) and their attributes (columns):

BORROWING:

borrow_date

return_date

member_id (Foreign Key – refers to Member)

book_id (Foreign Key – refers to Book)

librarian_id (Foreign Key – refers to Librarian)

key entities (tables) and their attributes (columns):

LIBRARIAN :

id (Primary Key)

name (composite to: first, last)

email

shift_time

key entities (tables) and their attributes (columns):

AUTHOR :

id (Primary Key)

name (composite to: first, last)

book_id (Foreign Key – refers to the Author's book)

Relationships Between tables:

ADMIN – BOOK (MANAGES):

- Each book is managed by **only one admin** and the same admin can manage **many books** at the same time (**Many to One**)

- **Total** (Book) to **Total** (Admin): Each Book must be managed by an admin , and there is no admin not managing any books.

Relationships Between tables:

BOOK – GENRE (HAS):

- Each book must belong to **one genre** and **many books** can belong to the same genre (**Many to One**)

- **Total** (Book) to **Partial** (Genre): Every book must belong to a genre , but It’s not a must that a genre has books belong to it .

Relationships Between tables:

MEMBER – BORROWING (BORROWS):

- Each member can make **many borrowing** transactions , but each borrowing transaction is only made by **one member** (**Many to One**).

- **Total** (Borrowing) to **Partial** (Member): Every borrowing transaction must be made by a member , but It’s not a must that every member makes borrowing transactions.

Relationships Between tables:

BOOK – BORROWING (IS_BORROWED):

- Each book can be **borrowed multiple times** , and multiple borrowing transactions can be made to borrow the **one same book** (**Many to One**).

- **Total** (Borrowing) to **Partial** (Book): Every transaction is made for borrowing a book , but It’s not a must that every book well be borrowed.

Relationships Between tables:

LIBRARIAN – BORROWING (SUPERVISES):

- Each borrowing tansaction is supervised by **one librarian** , and a librarian can supervise **many borrowing transactions** at the same time (**One to Many**).

- **Total** (Borrowing) to **Partial** (Librarian): Every borrowing transaction must be supervised by a librarian , but It’s not a must that every librarian has borrowing transactions to supervise.

Relationships Between tables:

BOOK – AUTHOR (WRITES):

- **Many Authors** can share writing one or many books, **Many Books** can be written by one or more Authors at the same time (**Many to Many**).

- **Total** (Books) to **Total** (Authors): No Book is written by no author , and every author must wrote at least one book.

ERD

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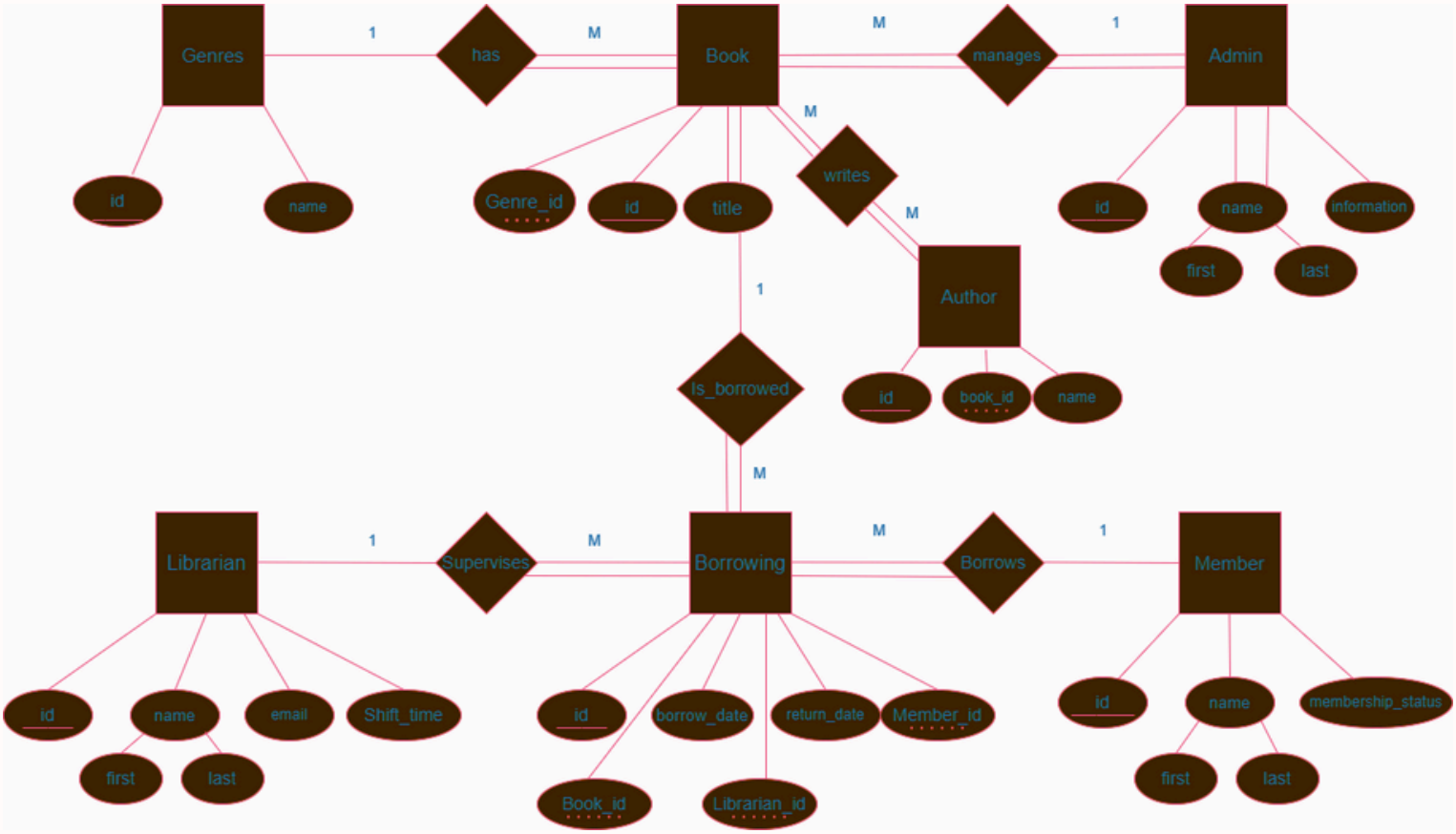

ERD Mapping

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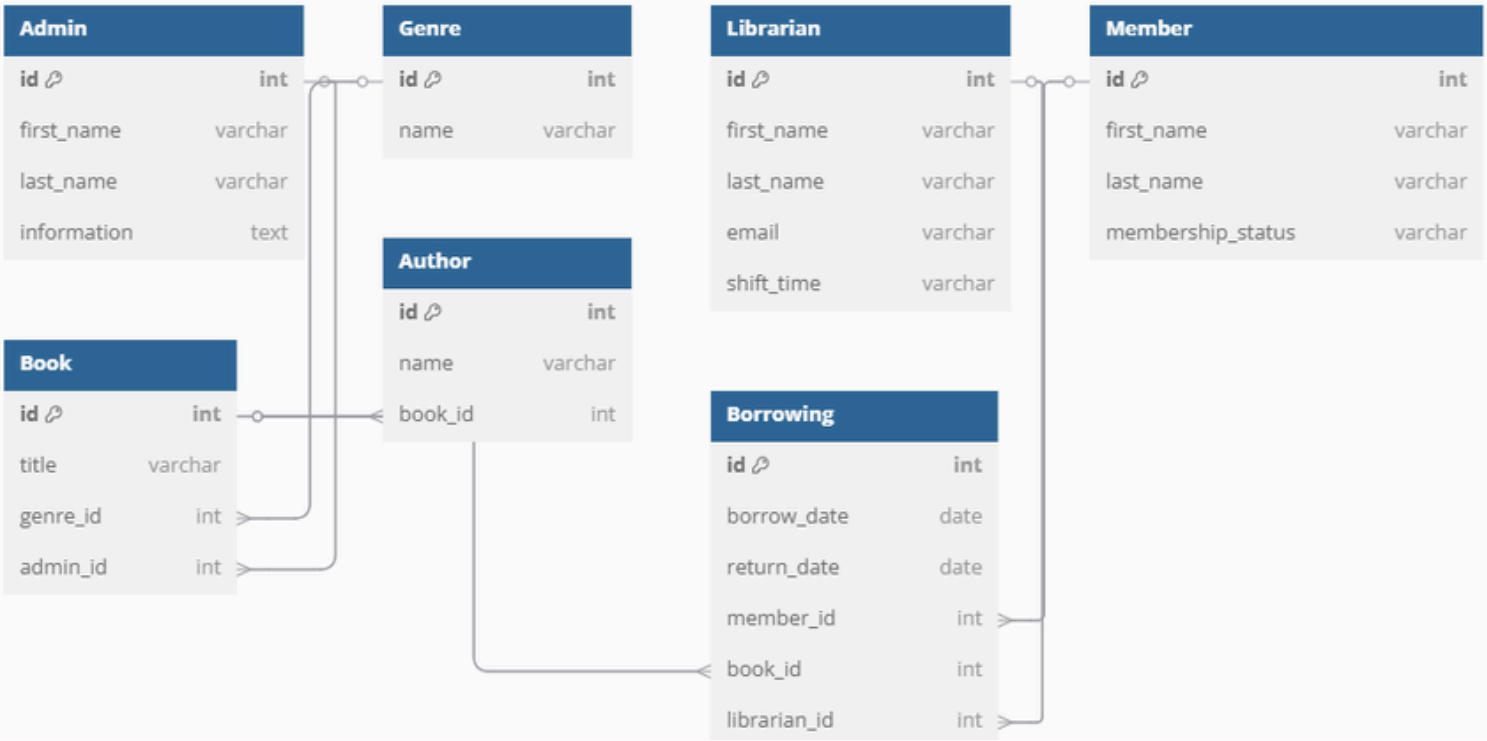

Normalization

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NF1:

- All attributes contain only atomic values : no multi-valued or composite attributes✅
- Each record (row) is unique : typically ensured by a primary key✅

NF2:

- It is already in 1NF✅
- no partial dependencies on a part of a composite key (All non-prime attributes are fully dependent on the entire primary key)✅

NF3:

- It is already in 2NF✅
- There are no transitive dependencies between non-prime attributes (non-key attributes do not depend on other non-key attributes)✅

Permissions:

user	Tables they can access	Operations (**Permissions**)
Admin	Book, Member, Genres, Author	Add, Update, Delete, View
Librarian	Borrowing, Member, Book	Add borrowing records, View books
Member	Book, Borrowing	View books, View borrow history

APPLYING SQL QUERIES:

Database after creation

```
MariaDB [(none)]> USE mydb;
Database changed
MariaDB [mydb]> SHOW TABLES;
+----------------+
| Tables_in_mydb |
+----------------+
| admin          |
| author         |
| book           |
| borrowing      |
| genres         |
| member         |
| Librarian      |
+----------------+
7 rows in set (0.001 sec)
```

Insert 10 rows per table

Admin

```
MariaDB [mydb]> INSERT INTO Admin (id, first_name, last_name, information) VALUES
    -> (1, 'Ali', 'Hassan', 'Main Librarian'),
    -> (2, 'Sara', 'Ahmed', 'Assistant'),
    -> (3, 'Omar', 'Yousef', 'IT Support'),
    -> (4, 'Lina', 'Salem', 'Manager'),
    -> (5, 'Hadi', 'Kamal', 'Intern'),
    -> (6, 'Nada', 'Zaki', 'Coordinator'),
    -> (7, 'Ziad', 'Fahmy', 'Archivist'),
    -> (8, 'Reem', 'Ali', 'Clerk'),
    -> (9, 'Amr', 'Tarek', 'Security'),
    -> (10, 'Dina', 'Samir', 'HR');
Query OK, 10 rows affected (0.028 sec)
Records: 10  Duplicates: 0  Warnings: 0
```

Genres

```
MariaDB [mydb]> INSERT INTO Genres (id, name) VALUES
    -> (1, 'Fiction'),
    -> (2, 'Science'),
    -> (3, 'History'),
    -> (4, 'Biography'),
    -> (5, 'Fantasy'),
    -> (6, 'Philosophy'),
    -> (7, 'Mystery'),
    -> (8, 'Horror'),
    -> (9, 'Romance'),
    -> (10, 'Self-help');
Query OK, 10 rows affected (0.014 sec)
Records: 10  Duplicates: 0  Warnings: 0
```

Insert 10 rows per table

Book

```
MariaDB [mydb]> INSERT INTO Book (id, title, genre_id, admin_id) VALUES
    -> (1, '1984', 1, 1),
    -> (2, 'Time Brief', 2, 2),
    -> (3, 'Sapiens', 3, 3),
    -> (4, 'Steve Jobs', 4, 4),
    -> (5, 'Harry Potter', 5, 5),
    -> (6, 'The Republic', 6, 6),
    -> (7, 'Sherlock', 7, 7),
    -> (8, 'IT', 8, 8),
    -> (9, 'Love Story', 9, 9),
    -> (10, 'Atomic Habits', 10, 10);
Query OK, 10 rows affected (0.015 sec)
Records: 10  Duplicates: 0  Warnings: 0
```

Member

```
MariaDB [mydb]> INSERT INTO Member (id, first_name, last_name, membership_status) VALUES
    -> (1, 'Khaled', 'Nasser', 'Active'),
    -> (2, 'Laila', 'Youssef', 'Inactive'),
    -> (3, 'Mona', 'Hassan', 'Active'),
    -> (4, 'Salma', 'Zayed', 'Active'),
    -> (5, 'Ahmed', 'Omar', 'Inactive'),
    -> (6, 'Yara', 'Mohamed', 'Active'),
    -> (7, 'Tamer', 'Ali', 'Active'),
    -> (8, 'Nour', 'Gamal', 'Inactive'),
    -> (9, 'Rami', 'Ibrahim', 'Active'),
    -> (10, 'Dalia', 'Sami', 'Active');
Query OK, 10 rows affected (0.015 sec)
Records: 10  Duplicates: 0  Warnings: 0
```

Insert 10 rows per table

Borrowing

```
MariaDB [mydb]> INSERT INTO Borrowing (id, member_id, book_id, borrow_date, return_date) VALUES
    -> (1, 1, 1, '2025-05-01', '2025-05-10'),
    -> (2, 2, 2, '2025-05-02', NULL),
    -> (3, 3, 3, '2025-05-03', '2025-05-07'),
    -> (4, 4, 4, '2025-05-04', NULL),
    -> (5, 5, 5, '2025-05-05', '2025-05-15'),
    -> (6, 6, 6, '2025-05-06', '2025-05-12'),
    -> (7, 7, 7, '2025-05-07', NULL),
    -> (8, 8, 8, '2025-05-08', '2025-05-14'),
    -> (9, 9, 9, '2025-05-09', NULL),
    -> (10, 10, 10, '2025-05-10', NULL);
Query OK, 10 rows affected (0.005 sec)
Records: 10  Duplicates: 0  Warnings: 0
```

Librarian

```
MariaDB [mydb]>INSERT INTO Librarian (id , first_name , last_name , shift_time , email) VALUES
    -> (1, 'Ahmed', 'Hassan', 'Morning', 'ahmed.hassan@example.com'),
    -> (2, 'Sara', 'Ali', 'Evening', 'sara.ali@example.com'),
    -> (3, 'Omar', 'Youssef', 'Night', 'omar.youssef@example.com'),
    -> (4, 'Laila', 'Mostafa', 'Morning', 'laila.mostafa@example.com'),
    -> (5, 'Khaled', 'Nabil', 'Evening', 'khaled.nabil@example.com');
    -> (6, 'Mona', 'Ibrahim', 'Night', 'mona.ibrahim@example.com'),
    -> (7, 'Tamer', 'Adel', 'Morning', 'tamer.adel@example.com'),
    -> (8, 'Nour', 'Fathy', 'Evening', 'nour.fathy@example.com'),
    -> (9, 'Hany', 'Kamal', 'Night', 'hany.kamal@example.com'),
    -> (10, 'Rania', 'Sami', 'Morning', 'rania.sami@example.com');
Query OK, 10 rows affected (0.005 sec)
Records: 10  Duplicates: 0  Warnings: 0
```

Insert 10 rows per table

Author

```
MariaDB [mydb]> INSERT INTO Author (id, name, book_id) VALUES
    -> (1, 'George Orwell', 1),
    -> (2, 'Stephen Hawking', 2),
    -> (3, 'Yuval Harari', 3),
    -> (4, 'Walter Isaacson', 4),
    -> (5, 'J.K. Rowling', 5),
    -> (6, 'Plato', 6),
    -> (7, 'Arthur Conan Doyle', 7),
    -> (8, 'Stephen King', 8),
    -> (9, 'Erich Segal', 9),
    -> (10, 'James Clear', 10);
Query OK, 10 rows affected (0.015 sec)
Records: 10  Duplicates: 0  Warnings: 0
```

SQL Queries

```
MariaDB [mydb]> SELECT * FROM Member WHERE membership_status = 'Active';
+----+------------+-----------+-------------------+
| id | first_name | last_name | membership_status |
+----+------------+-----------+-------------------+
|  1 | Khaled     | Nasser    | Active            |
|  3 | Mona       | Hassan    | Active            |
|  4 | Salma      | Zayed     | Active            |
|  6 | Yara       | Mohamed   | Active            |
|  7 | Tamer      | Ali       | Active            |
|  9 | Rami       | Ibrahim   | Active            |
| 10 | Dalia      | Sami      | Active            |
+----+------------+-----------+-------------------+
7 rows in set (0.001 sec)
```

```
MariaDB [mydb]> SELECT * FROM Member
    -> LIMIT 5;
+----+------------+-----------+-------------------+
| id | first_name | last_name | membership_status |
+----+------------+-----------+-------------------+
|  1 | Khaled     | Nasser    | Active            |
|  2 | Laila      | Youssef   | Inactive          |
|  3 | Mona       | Hassan    | Active            |
|  4 | Salma      | Zayed     | Active            |
|  5 | Ahmed      | Omar      | Inactive          |
+----+------------+-----------+-------------------+
5 rows in set (0.001 sec)
```

SQL Queries

```
MariaDB [mydb]> SELECT Member.first_name, Member.last_name, Book.title
    -> FROM Borrowing
    -> JOIN Member ON Borrowing.member_id = Member.id
    -> JOIN Book ON Borrowing.book_id = Book.id;
+------------+-----------+---------------+
| first_name | last_name | title         |
+------------+-----------+---------------+
| Khaled     | Nasser    | 1984          |
| Laila      | Youssef   | Time Brief    |
| Mona       | Hassan    | Sapiens       |
| Salma      | Zayed     | Steve Jobs    |
| Ahmed      | Omar      | Harry Potter  |
| Yara       | Mohamed   | The Republic  |
| Tamer      | Ali       | Sherlock      |
| Nour       | Gamal     | IT            |
| Rami       | Ibrahim   | Love Story    |
| Dalia      | Sami      | Atomic Habits |
+------------+-----------+---------------+
10 rows in set (0.001 sec)
```

```
MariaDB [mydb]> SELECT * FROM Book
    -> WHERE title LIKE '%Time%';
+----+------------+----------+----------+
| id | title      | genre_id | admin_id |
+----+------------+----------+----------+
|  2 | Time Brief |        2 |        2 |
+----+------------+----------+----------+
1 row in set (0.001 sec)
```

SQL Queries

```
MariaDB [mydb]> UPDATE Member
    -> SET membership_status = 'Active'
    -> WHERE id = 2;
Query OK, 1 row affected (0.013 sec)
Rows matched: 1  Changed: 1  Warnings: 0
```