**Lab Assignment- 3**

*List out the entities and identify the relationship between them. Also, identify related attributes supposed to be recorded while considering the normalization rule.*

**Ans-**

In Library Management System, there are various entities and relationships that can be identified which are as follows-

**Entities:**

1. Books:

**- Attributes**: ISBN, Title, Author, Publisher, Publication Year, Genre, Language, Edition, Number of Copies, Available Copies, etc.

2. Authors:

- **Attributes:** Author ID, Name, Birthdate, Nationality, Biography, etc.

3. Publishers: - **Attributes:** Publisher ID, Name, Address, Contact Information, etc.

4. Users (Library Members):

- **Attributes:** User ID, Name, Address, Contact Information, Membership Type, Joining Date, etc.

5. Borrowing Transactions:

**- Attributes:** Transaction ID, User ID, Book ISBN, Borrow Date, Due Date, Return Date, Fine Amount etc.

6. Librarians:

- **Attributes:** Librarian ID, Name, Contact Information, Position, etc.

**Relationships:**

1**. Books - Authors:**

- Many-to-Many Relationship (A book can have multiple authors, and an author can write multiple books).

- An associative table is often used to link books to authors.

2**. Books - Publishers**:

- Many-to-One Relationship (A book is published by one publisher, but a publisher can have multiple

books).

- The "Publisher ID" is typically a foreign key in the "Books" table.

3. **Users - Borrowing Transactions**:

- One-to-Many Relationship (A user can have multiple borrowing transactions, but each transaction

is associated with one user).

- The "User ID" is a foreign key in the "Borrowing Transactions" table.

4**. Books - Borrowing Transactions:**

- Many-to-Many Relationship (A book can be borrowed by multiple users, and a user can borrow multiple books).

- An associative table is used to link books to borrowing transactions, typically recording attributes like "Borrow Date" and "Due Date."

5**. Librarians - Borrowing Transactions:**

- One-to-Many Relationship (A librarian can handle multiple borrowing transactions, but each transaction is associated with one librarian).

- The "Librarian ID" is a foreign key in the "Borrowing Transactions" table.

**Attributes to be recorded while considering normalization:**

Normalization is a process to organize data in a database efficiently to minimize redundancy and maintain data integrity. Here are some considerations for attributes:

1. Ensure that attributes are atomic, meaning they cannot be divided into smaller data elements.

For example, an author's name should be stored as two separate attributes, "First Name" and"Last Name."

2. Use appropriate data types for each attribute (e.g., using date data types for dates, numeric datatypes for numbers, and text data types for textual information).

3. Minimize redundant data by avoiding the repetition of information. For example, store the author's name in the "Authors" table and reference it using the author's ID in the "Books" table.

4. Avoid storing calculated values. For example, instead of storing the total fine amount for a user in the "Users" table, calculate it based on borrowing transactions.

5. Apply primary keys and foreign keys to maintain referential integrity between related tables.

6. Use normalization techniques (e.g., First Normal Form, Second Normal Form, Third Normal Form) to eliminate data anomalies and ensure efficient data storage and retrieval.

7. Handle attributes like multiple author names or multiple borrowing transactions with associative tables or appropriate data structures.

8. Store necessary indexes to optimize query performance, especially for frequently used attributes.

The actual design of a library management system database will depend on the specific requirements

and constraints of the system.