TITLE: PROJECT STAGE 1
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PROJECT SCOPE

The goal of this project is to design a database system for a public library that helps staff organize and track library resources as well as manage member information. The database should cover the following main areas:

Library Materials Management – Store details of books, magazines, e-books, and audiobooks, such as their title, author, genre, publication date, and availability.

Membership Management – Keep records of library members, including their names, contacts, membership number, and borrowing history.

Borrowing Transactions – Track when items are borrowed and returned, with borrow dates, due dates, and return dates.

Staff Operations – Record which librarian processes each borrowing or return, and allow staff to generate reports (e.g., popular books, overdue items, popular materials etc.)

This system will help reduce redundancy, keep the data consistent, and provide useful reports for decision-making.

Entities and the relationships

Entities

Materials: Captures all types of library resources (books, magazines, e-books, and audiobooks) to ensure the library can efficiently track availability, genre, publication date, and type. This prevents redundancy and supports accurate reporting.
Member: Stores essential information about library members, enabling tracking of borrowing history, membership validity, and communication. Unique membership numbers ensure each member is identifiable.

Borrowing Transaction: Records each borrowing transaction, including borrow date, due date, and return date. This allows the library to manage circulation, track overdue items, and generate usage reports.

Staff: Tracks who manages the transaction.

Material

Material_ID	Title	publication Date	Genre	Availability	Author	Type

PK

Member

Member_ID	Name	Contact_No	Membership_no	Date_Joined

PK

Borrowing

Borrow_ID	Borrow_Date	Due_Date	return_Date	Material_ID	Member_ID	Staff_ID

PK FK FK FK

Staff

Staff_ID	Staff_Name	Role	Contact

PK

Relationships

1. **Borrow**

- **Between:** Member and Borrowing Transaction
- **Meaning:** A member **borrows** materials via borrowing transactions.
- **Type:** 1:M (one member can have multiple borrowing transactions)

2. **Manage**

- **Between:** Staff and Borrowing Transaction
- **Meaning:** Staff **manage** borrowing transactions (check-out, return, and update).
- **Type:** 1:M (one staff can manage many transactions, each transaction managed by one staff)

3. **Includes**

- **Between:** Borrowing Transaction ↔ Materials
- **Meaning:** A borrowing transaction **includes** one or more materials.
- **Type:** M:N (a transaction can include multiple materials, and each material can appear in many transactions)

Functions of the Database

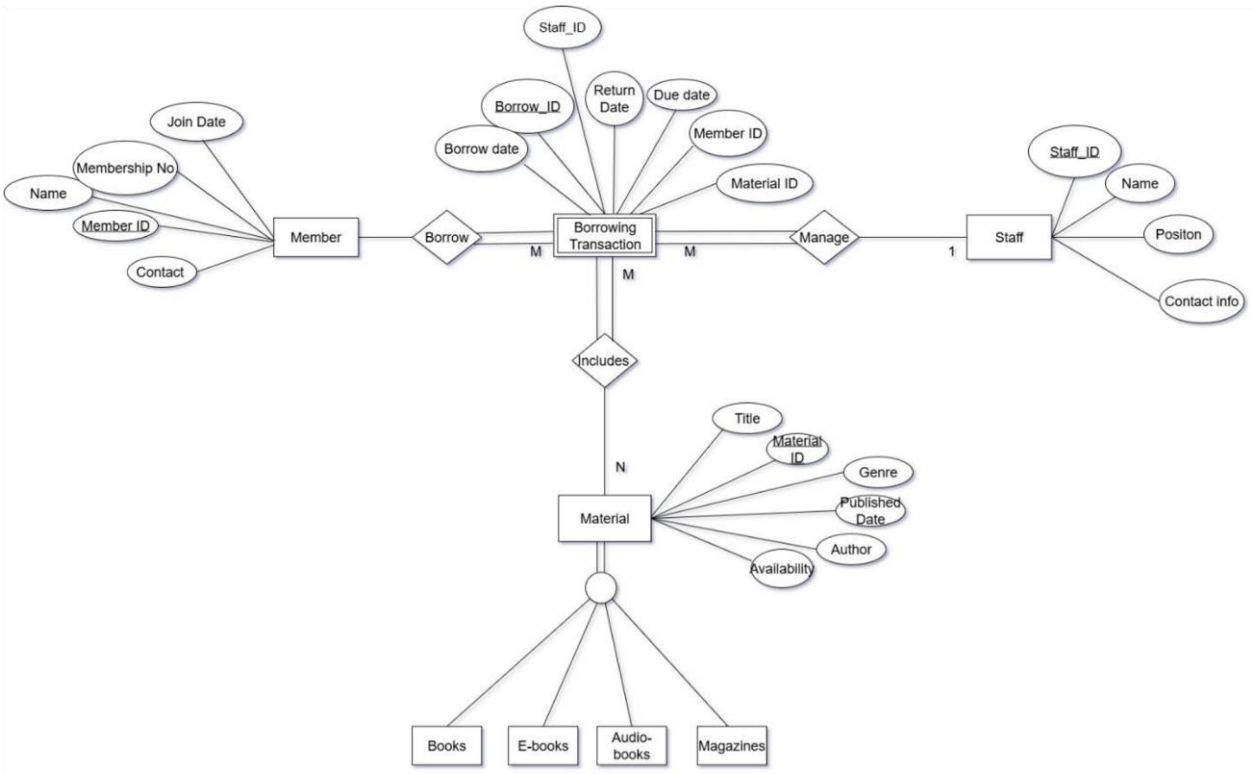
The Public Library Database will provide the following functions based on the identified entities and relationships:

1. **Materials Management** – Add, update, or remove library materials (books, magazines, ebooks, and audiobooks) while keeping track of their details such as title, author, publication date, genre, and type.
2. **Membership Management** – Register new members, maintain contact information, assign unique membership numbers, and track borrowing history.
3. **Borrowing Transactions** – Record when members borrow materials, including borrow date, due date, and return date, ensuring overdue items can be tracked.
4. **Staff Operations** – Track which staff member manages each borrowing transaction to ensure accountability and efficient circulation management.

Reporting and Analytics – Generate reports on library usage, popular materials, overdue items, and staff activity to support data-driven decision-making

ER DIAGRAM

The ER diagram represents the database schema for the Public Library system. It captures the key entities, their attributes, and the relationships that define how library operations are managed.



Assumptions

- Each material has a single author (multi-author resources are not considered at this stage). Each borrowing transaction is managed by exactly one staff member.
- Each borrowing transaction is linked to one member, but a member can perform many borrowing transactions.
- A borrowing transaction can include multiple materials.
- A material can appear in many different borrowing transactions over time.
- Membership numbers are unique and permanently assigned to each member.
- A material's availability is determined from its borrow and return dates recorded in transactions.

Justification of Design Choices

- A single **Materials entity** was used to represent all resource types (books, magazines, ebooks, and audiobooks). This avoids redundancy by keeping all materials in one table.
- The **Borrowing Transaction entity** was included to capture the details of each borrow event. It links to **Member** (via *Borrow*) to track borrowing history and to **Staff** (via *Manage*) to record who processed the transaction.
- The **Includes relationship** between Borrowing Transaction and Materials was modeled as a many-to-many relationship. A junction table resolves this relationship, allowing multiple materials to be associated with one transaction and vice versa.

- Normalization was applied to reduce redundancy and ensure that attributes depend only on the primary keys of their respective entities.

RELATIONAL SCHEMA

This schema ensures:

- **Normalization:** No redundant data; all tables are at least in 3NF.
- **Referential integrity:** FKs link tables correctly.
- **Support for operations:** Tracks who borrowed what, when, and who managed the transaction.