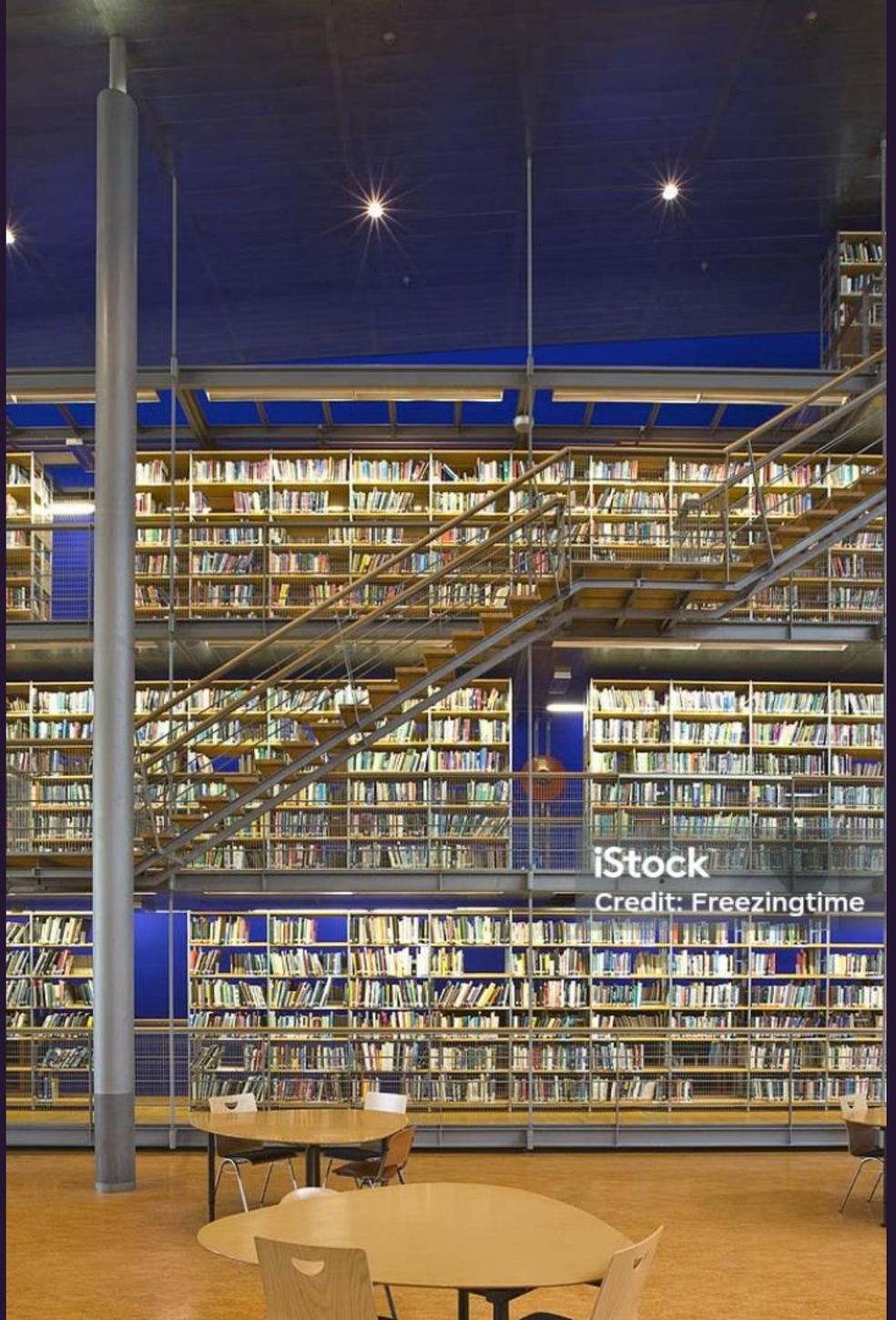


Library Book Borrowing & Return System

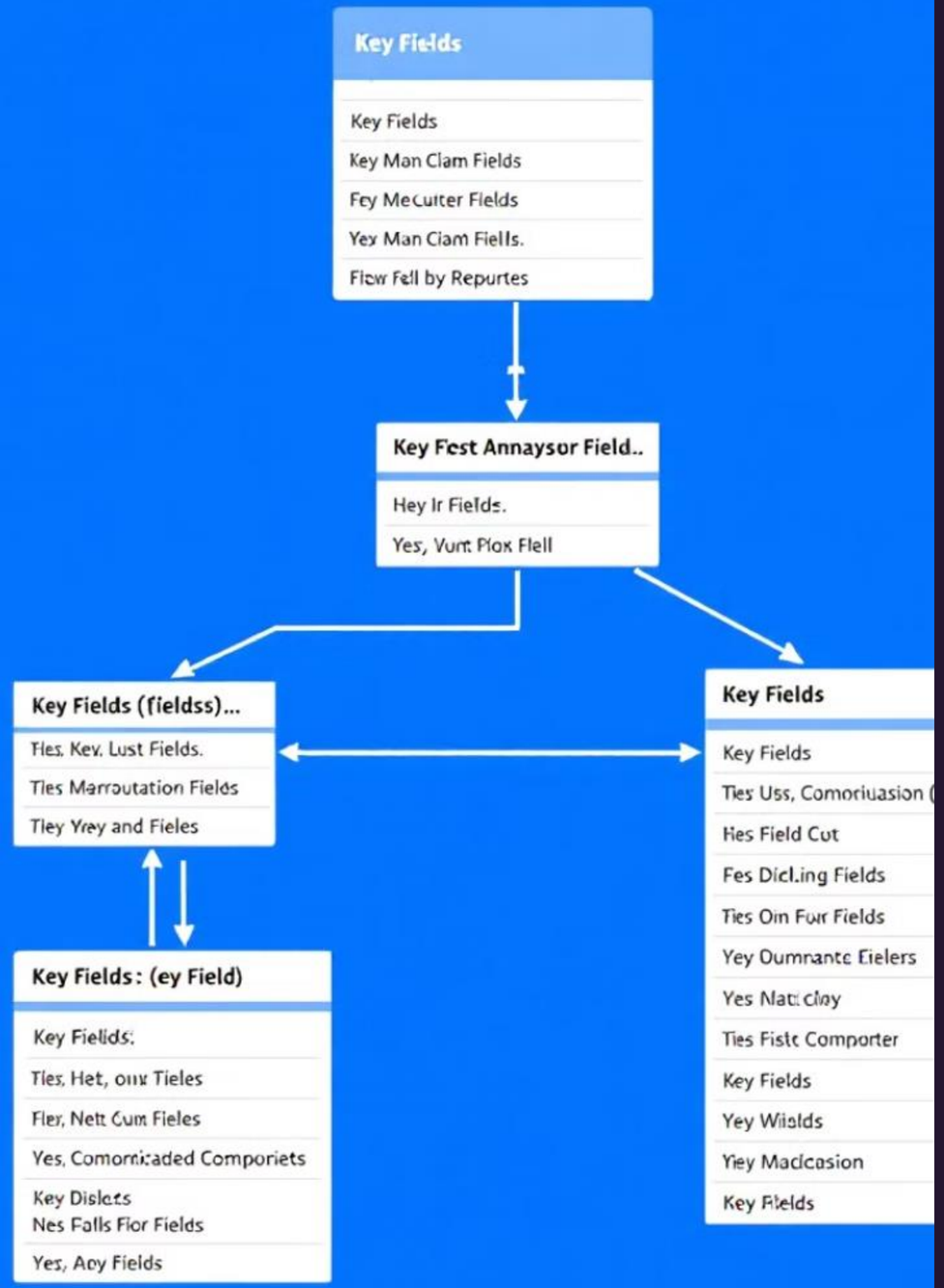
Libraries often struggle with the cumbersome process of tracking borrowed books, managing due dates, and handling returns. Traditional manual systems are prone to inefficiencies, leading to misplaced books, overdue returns, and an increased workload for library staff. The implementation of a digital solution offers a streamlined approach to automate book borrowing, returning, and fine calculation, addressing these key challenges.

COURSE CODE & NAME: Database Development with PL/SQL INSY 8311

LECTURER: Eric Maniraguha

NAMES: Niyitanga nsengiyumva Olga

ID: 26694



Main Entities in the Database

The core of the digital library system lies in its **structured** database, comprising three main entities to manage books, members, and loans efficiently.

Books Table

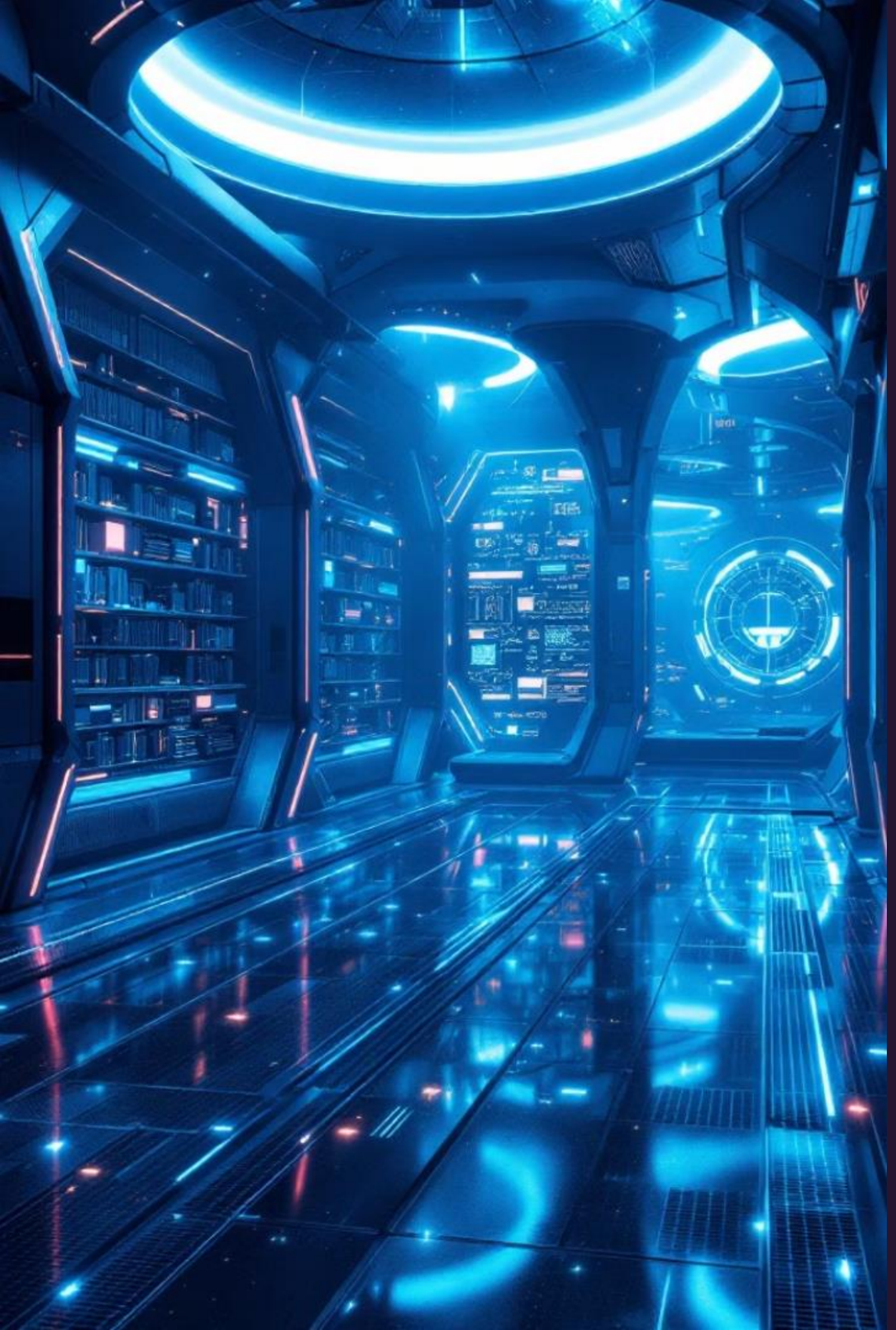
- Stores book ID, title, author, ISBN, publication year, genre, and number of copies.
- A unique identifier for each book.

Members Table

- Includes member ID, first name, last name, address, phone number, and email address.
- Contains unique member identifiers and personal details.

Loans Table

- Tracks loan ID, book ID, member ID, loan date, due date, return date, and fine amount.
- Manages loan transactions.



Benefits of a Digital Solution

Implementing a digital solution for library book borrowing and return systems offers several key advantages.

Automated Tracking

Real-time tracking of book locations and due dates.

Improved Efficiency

Reduces staff workload and minimizes manual errors.

Enhanced Accuracy

Accurate record-keeping of loans, returns, and fines.

Data-Driven Insights

Generates reports on borrowing patterns and popular titles.

Phase II: Business Process Modeling

Overview / Introduction

This phase focuses on modeling the business processes involved in managing the borrowing and returning of books in a university library. The objective is to understand how information flows among users, how tasks are handled by different roles, and how decision-making is enhanced through MIS principles. The process is visualized using UML swimlane diagrams to represent actor interactions and decision logic.

1. Define the Scope

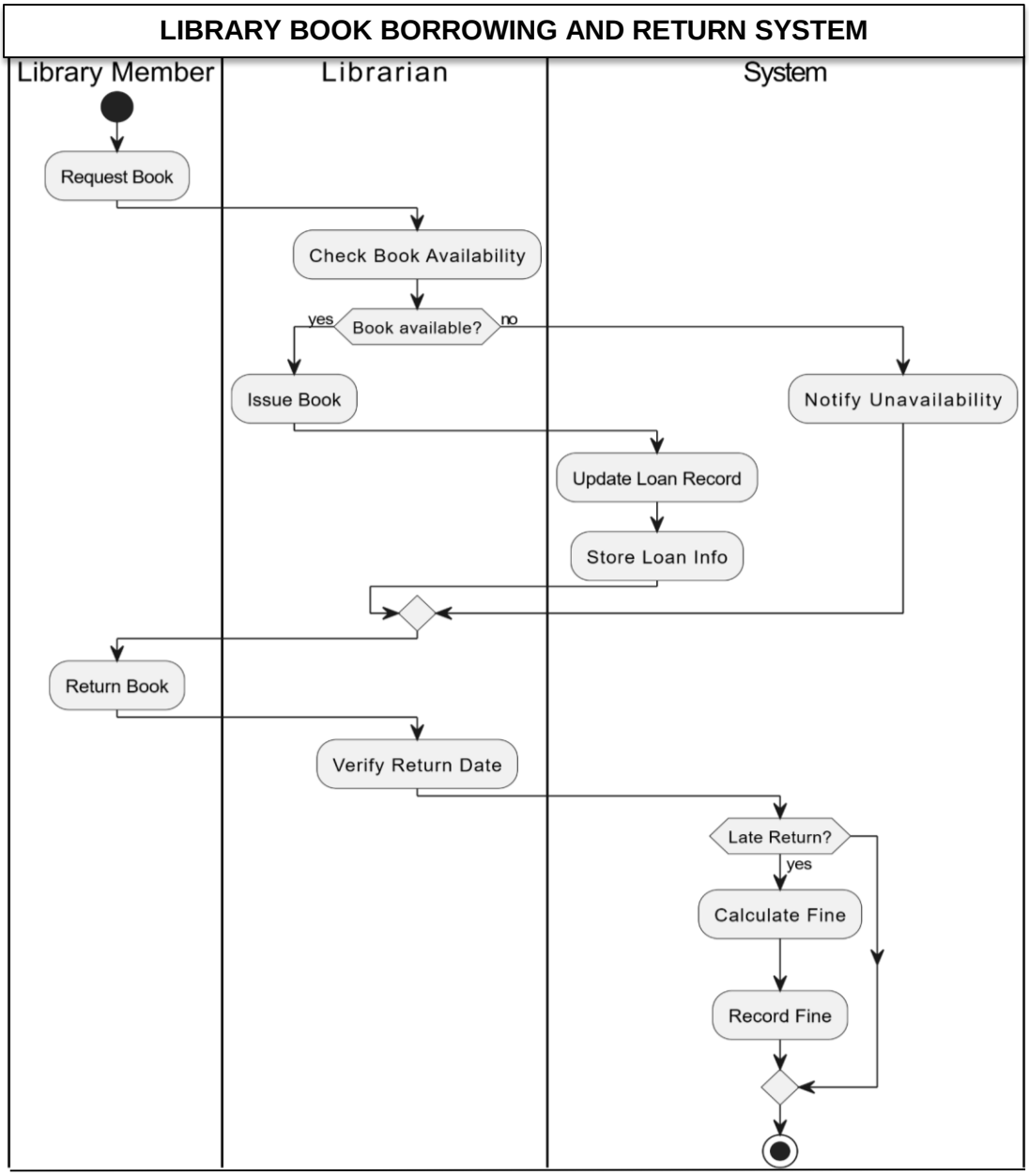
Business Process Name: Library Book Borrowing and Return Process
Scope: The process models how a university library manages lending and returning of books. It automates workflows between members, librarians, and the system to improve information accuracy and reduce manual operations.
Relevance to MIS: Supports decision-making by collecting and analysing data on loans, returns, and fines. Helps in managing library resources more efficiently.

2. Identify Key Entities

- **Library Member**: Initiates borrowing or returning of books. Interacts with the librarian.
- **Librarian**: Handles book availability checks, issues and receives books, validates returns.
- **System Database**: Records transactions, calculates due dates, applies fines for late returns.
- **MIS Report Generator**: Summarizes borrowing frequency, overdue trends, and popular books. Helps management plan purchases and monitor usage.

3. Use Swimlanes for Clarity

Diagram:



4. Apply UML/BPMN Notations

- **Start/Stop**: Begin and end points of the process
- **Activities**: Represented as rounded rectangles (e.g., Request Book, Return Book)
- **Decisions**: Diamonds for Yes/No logic (e.g., Book Available, Late Return)
- **Data flows**: Implicitly handled by sequencing
- **Actors**: Separated using swimlanes (Member, Librarian, System)
- **Tool Used**: PlantUML compatible with draw.io for visual clarity

5. Ensure a Logical Flow

The model starts when a member requests a book. The librarian checks availability and either issues the book or denies it. If issued, the system logs the loan. Upon return, the librarian verifies the return, and the system applies fines if necessary.

This flow clearly shows:

- Tasks performed by each actor
- Decisions made during the process
- How data is recorded and managed

6. Prepare an Explanation

Diagram Explanation – Library Book Borrowing & Return Process

The swimlane diagram represents the end-to-end process of borrowing and returning books in a university library system. It clearly shows how tasks are distributed among three main participants: the **Library Member**, the **Librarian**, and the **System**.

Main Components and Their Interactions

- **Library Member**: Initiates the process by requesting a book and later returning it. The member interacts directly with the librarian.
- **Librarian**: Checks the availability of the requested book, issues the book if available, and validates returns. The librarian plays a critical role in managing access and enforcing rules.
- **System**: Automatically updates loan records, stores transactions, checks return status, and calculates fines for late returns. It ensures accurate data management and supports automation.

Each swimlane outlines specific tasks performed by the respective actor, and decisions (e.g., "Book available?", "Late return?") guide the flow to appropriate next steps.

How the Process Supports MIS Functions

This diagram reflects a structured, digital system that directly supports **Management Information Systems (MIS)** through:

- **Data Accuracy**: Reduces manual entry errors by automating updates and validations.
- **Real-Time Tracking**: The system logs each transaction, supporting timely access to records.
- **Decision Support**: MIS can analyze fine history, borrowing patterns, and book demand to aid in budget allocation, acquisitions, and policy creation.
- **Reporting**: Helps librarians and administrators generate usage reports, monitor overdue behavior, and adjust resources accordingly.

Why the Process Is Important for Organizational Efficiency

Implementing this process improves operational efficiency by:

- **Eliminating manual paperwork**
- **Accelerating transactions** (especially book check-outs and returns)
- **Enhancing accountability** (every step is traceable)
- **Allowing scalability** for managing a large library system without increasing workload

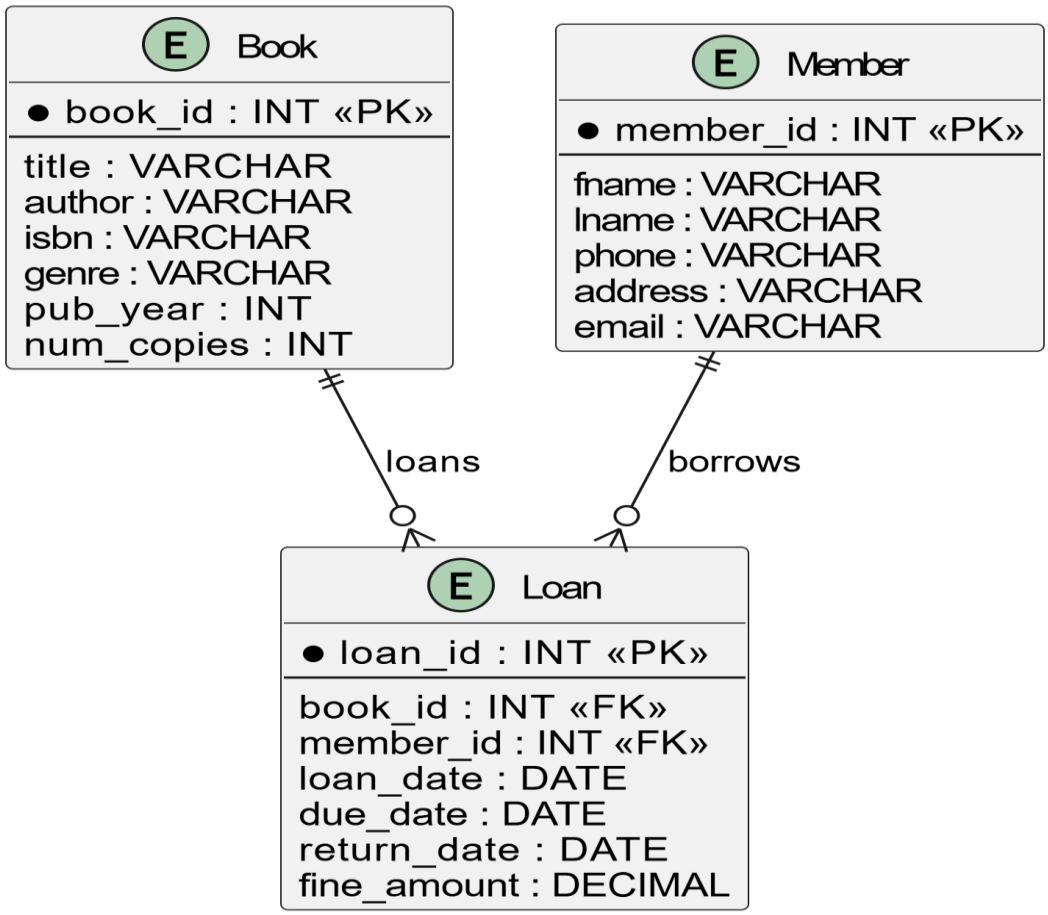
By visualizing this process, the institution gains a clear roadmap for implementing or enhancing its digital library system, aligning it with organizational goals and modern academic service delivery.

Phase III: Logical Model Design

Overview / Introduction

This phase involves designing a normalized logical data model based on the problem identified in Phase I and the business process modeled in Phase II. The Entity-Relationship Diagram (ERD) serves as a blueprint for how data is structured, how entities are related, and how constraints are applied to ensure consistency and integrity. This design will be the foundation for implementing the actual PL/SQL database.

1. Entity Relationship Diagram (ERD)



2. Relationships and Constraints

- **Book → Loan**: One book can be loaned many times (1:M)
- **Member → Loan**: One member can borrow many books (1:M)
- **Constraints**:

    - PKs: book_id, member_id, loan_id
    - FKs: book_id (in Loan), member_id (in Loan)
    - NOT NULL for all attributes
    - CHECK constraint on fine_amount to ensure it is >= 0

3. Normalization

All entities follow **3rd Normal Form (3NF)**:

- No repeating groups or multivalued attributes
- All attributes depend only on their PKs
- No transitive dependencies (e.g., member details only in Member table)

4. Handling Data Scenarios

- Member borrows multiple books
- Book is loaned to different members over time
- System calculates fines if return is late
- Supports reports on top borrowed books and frequent borrowers

Conclusion

Phase III concludes the design part of the project by providing a robust, normalized logical model that reflects the real-world operations of a library system. The ERD ensures that data is properly structured to allow efficient queries, enforce integrity, and support the PL/SQL implementation in future phases. This phase bridges the gap between planning and actual system development.