# Library System Programming Project

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## Introduction

This document outlines the design of a Library Management System developed as part of the CS-6360 Database Design course. The system is designed to manage book loans, returns, and fines in a library environment primarily used by librarians.

## System Overview

The Library Management System is a comprehensive tool designed to simplify the management of library resources. Targeted users are librarians who require efficient and reliable software to handle book searches, checkouts, returns, and borrower account management.

## System Architecture

### GUI (Graphical User Interface)

- **Technology:** The system's user interface is built using Tkinter
- **Design Principles:** The GUI is designed to be user-friendly, with an emphasis on intuitive navigation and clear display of information.

### Database

- **Technology:** MySQL
- **Schema Overview:** The schema includes tables for books as BOOK, authors as AUTHORS and BOOK_AUTHORS, borrowers as BORROWERS, loans as BOOK_LOANS, and fines as FINES, structured to efficiently store and retrieve library data.

### Logic

- **Implementation:** The main functionality is programmed in Python
- **Integration:** The Python application interacts with the MySQL Database Server using PyMySQL, a pure-Python MySQL client library, ensuring seamless database connectivity.

## Design Decisions

### Python and Tkinter for GUI Development

Python's simplicity and versatility make it ideal for rapid development and user interface design, enabling quick iterations and adaptability. Tkinter, as an integral part of Python, offers an uncomplicated approach to GUI creation, focusing on user-friendliness. Together, Python and Tkinter are cross-platform compatible, allowing our application to operate seamlessly across different operating systems, thus enhancing accessibility and usability in diverse library settings.

**MySQL for Database Management**

MySQL is renowned for its reliability and performance in managing structured data, a key factor in its widespread industry adoption and our choice for the Library Management System. Its scalability caters to the growing data needs of the library, maintaining system responsiveness and efficiency. Additionally, MySQL's robust security features and data integrity capabilities are crucial for safeguarding sensitive borrower information. Furthermore, the strong community support and extensive documentation of MySQL enhance its reliability and long-term viability

# Assumptions

- Two books with same name and authors but different ISBN treated as different books.
- Phone numbers must 10 digits
- Social Security Number (SSN) must be 9 digits and is unique for every Borrower.
- The Borrower must have a Name and Address.
- The ISBN10 has been used as the book ISBN.
- Book Search during checkout is done by a entering a search pattern, this pattern is matched with the ISBN, the book name and the Author Name one after the other i.e., the pattern is matched with one attribute at a time.
- We can check out a maximum of 3 books at a time.
- At any point of time, a borrower can only have 3 open book loans.
- If the borrower has any books past due date, they need to be returned and fines must be paid before borrowing a new book.
- The search during check in is done by entering a search pattern, this pattern is matched Card ID, the ISBN and the name of the borrower one after the other i.e., the pattern is matched with one attribute at a time.
- we can check-in only one at a time.
- Borrowers must return all overdue books before paying fines.
- New book loans require clearing of overdue books and unpaid fines.
- Fines cannot be paid partially.

# Overview

To add a borrower in the library system, the "ADD BORROWER" button is clicked and necessary details like SSN, Name, Phone Number, and Address are entered. The system checks for unique SSN and format correctness, displaying error messages for any discrepancies. A unique Card ID, essential for all transactions, is assigned and displayed immediately. The "DISPLAY BORROWER DETAILS" feature allows for later retrieval of borrower information using SSN, phone number, or name and address.

For book check-outs, the "CHECK-OUT BOOK" button matches entered patterns with ISBN, book names, and author names, displaying up to three selectable books. Exceeding this limit

triggers an error message. Upon book selection and Card ID verification on the "ISSUE BOOK" page, books are issued unless the borrower exceeds the three-book limit, in which case an error is displayed.

Book availability is checked in the "AVAILABLE" column in the CHECK-OUT search, with unavailable selections prompting an error. For check-ins, the "CHECK-IN BOOK" button matches entered patterns to available records, allowing one book to be checked in at a time with a confirmation message upon successful check-in.

Fines are managed through the "REFRESH FINES" button, displaying updated fines grouped by Card ID, and the "PAY FINES" button, requiring a valid Card ID for fine display. Fines must be paid in full before returning overdue books, with relevant messages displayed for any discrepancies in the process.

# Additional Features Implemented

**Displaying Borrower Details**

After successfully registering a new borrower in the system, their unique Card ID is immediately displayed in a message box, providing instant confirmation of the registration. To facilitate easy access and review of borrower details, the system features a 'Display Borrower Details' button, which opens a window. Within this window, librarians can swiftly retrieve comprehensive information about any borrower, including their Card ID. This can be achieved by inputting any single piece of identifying information such as the borrower's Social Security Number (SSN), name, address, or phone number. Upon entering one of these details, the system promptly presents the complete borrower profile, encompassing all pertinent information along with the Card ID. This streamlined process ensures efficient and hassle-free management of borrower data, significantly enhancing user experience and operational efficiency.

**Display of fines**

The 'Refresh Fines' feature in the system serves as a dynamic tool for updating and reviewing fine-related information. When this button is clicked, the system initiates a thorough check for any outstanding fines. If there are no fines currently registered in the system, it promptly displays a notification stating, “Refresh Fines Completed. No existing fines to display.” This message serves as a clear confirmation that the fines have been updated and there are no pending charges. Conversely, if there are outstanding fines, the system immediately displays these details, allowing librarians to efficiently manage and address any financial obligations related to late returns. This feature ensures that the fines are always up to date, reflecting the latest information for accurate management.