

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

FAKULTI TEKNOLOGI MAKLUMAT DAN KOMUNIKASI

W O R K S H O P 1

R E P O R T

Name : Riswan bin Hamua

Matric Number : B032310741

Program : BITE S1G1

Project Title : Library Management System

Supervisor Name : TS. MUHAMMAD HELMY BIN EMRAN

Supervisor Signature :

Evaluator Name : PROFESOR MADYA TS. DR. AHMAD NAIM BIN CHE PEE @ CHE HANAPI

EXECUTIVE SUMMARY

The **Library Management System** is designed to help librarians manage their libraries more efficiently. This system simplifies tasks such as tracking book inventory, managing member records, and processing borrowing transactions. When a book title or ID is entered, the system provides details about the book, including its availability, author, publication date, and location in the library.

The system offers an intuitive and user-friendly interface, making it easy for librarians, staff, and members to navigate and use the platform. In large libraries, manually handling books and member records can be challenging. The Library Management System automates these processes, ensuring accurate and up-to-date information. It is updated in real-time whenever new books are added or borrowed.

When a book is borrowed or returned, the system automatically updates the records and calculates overdue fines if necessary. To develop this system, **Microsoft Visual Studio** with **C++** will be used for programming, and **MySQL** will serve as the database for storing all library-related data.

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CHAPTER 1: INTRODUCTION

1.1 Introduction

The Library Management System falls under the domain of Business & Services, specifically focusing on improving the efficiency and effectiveness of library operations. Libraries play a vital role in providing access to educational and informational resources, but many still rely on manual processes for managing their collections, member records, and transactions. These outdated methods often lead to inefficiencies, errors, and delays, which can negatively impact the quality of service provided to library patrons.

In today's fast-paced digital age, the need for automation in library management has become increasingly important. The Library Management System aims to address these challenges by automating key processes such as book inventory management, member registration, borrowing and returning transactions, and overdue fine calculations. By leveraging modern technologies like C++ for programming and MySQL for database management, the system provides a robust and scalable solution for libraries of all sizes.

The primary goal of this project is to create a system that not only simplifies the management process for librarians but also enhances the overall experience for library members. By automating routine tasks, the system reduces the administrative burden on library staff, allowing them to focus on providing better services to their patrons. Additionally, the system ensures real-time updates and accurate record-keeping, minimizing errors and discrepancies in book availability and member records.

In summary, the Library Management System represents a significant step forward in modernizing library operations. By automating key processes and providing a user-friendly interface, the system aims to improve operational efficiency, enhance data accuracy, and provide a better experience for both library staff and members.

1.2 Problem Statement

1. **Crowded Library Spaces**: During peak periods, such as exam seasons or special events, libraries often experience overcrowding. This makes it difficult for staff to manage book borrowing and returning processes efficiently, leading to long queues and delays in service.

2. **Inaccurate Book Tracking**: Manual tracking of book availability often results in errors, such as double bookings or lost materials. Without real-time updates, librarians cannot provide accurate information to members about the availability of books, leading to frustration and dissatisfaction.

3. **Delayed Updates on Borrowing Records**: Manually updating borrowing histories is time-consuming and prone to errors. Delays in updating member records can cause discrepancies, such as books being marked as available when they are still in possession of a member, or confusion over due dates.

4. **Inaccurate Overdue Fine Calculations**: Overdue fines are often calculated manually, which increases the risk of human error. Librarians may either overcharge or undercharge members, leading to disputes and dissatisfaction. Additionally, manual calculations are time-consuming, especially when managing a large volume of borrowed books.

5. **Time-Consuming Report Generation**: Generating reports manually, such as those for overdue books, borrowing trends, or popular titles, takes significant time and effort. This limits the ability of librarians to make informed decisions about inventory management or provide insights into the usage of the library's resources.

1.3 Objective (s) of the project

This project embarks on the following objectives:

1. To investigate the current challenges faced by libraries in managing books, members, and transactions manually.
2. To design a Library Management System that automates the management of book inventory, member records, and borrowing transactions.
3. To conclude the development of the Library Management System by implementing features such as realtime data tracking, overdue fine calculations, and report generation.

1.4 Scope

1.4.1 Module to be developed

1. Authentication Module

- Register
- Login
- Authentication
- Forgot Password

2. User Management Module

- Add / Edit / Delete User
- Search User

3. Book Management Module

- Add New Book
- Edit / Delete Book
- Search Book

4. Borrowing and Returning Module

- Borrow Book
- Return Book
- View Borrowing History

5. Overdue and Fine Management Module

- Track Overdue Books
- Calculate Fines
- Pay Fines

6. Reports and Analytics Module

- Generate Borrowing Reports
- Generate Overdue Reports
- Generate Inventory Reports

7. Category Management Module

- Add / Edit / Delete Category
- Search Category

8. Notification Module

- Due Date Reminders
- Overdue Notifications
- New Book Alerts

9. Admin Dashboard Module

- System Overview
- User Activity Tracking
- System Settings

1.4.2 Target User

1. Administrator

- Responsible for managing the system, staff, and library inventory.
    - Login
    - Manage Staff (CRUD)
    - Manage Book (CRUD)
    - Generate Reports (Borrowing, Overdue, Top Borrowers)
    - Logout

2. Staff / Librarian

- Responsible for day-to-day operations, including managing book inventory and assisting students.
    - Login
    - Assisting the Borrow and Return book process.
    - Manage Books (CRUD)
    - Manage Students (CRUD)
    - Logout

3. Student

- Students need to register to log in to the system to borrow books. They can view their borrowing history and pay fines if applicable.
    - Login
    - View Available Books
    - View Borrowed Books
    - Check Borrowing Limits
    - View Borrowing History
    - Check Fines
    - Logout

1.5 Project Significance

1) Enhancing library management efficiency

The library management system streamlines daily operations, reducing manual workload for librarians and staff. By automating tasks such as cataloging, circulation, and patron management, the system enables library personnel to focus on providing better services to users and optimizing resource allocation.

2) Improving user experience and accessibility

The system offers a user-friendly interface that allows patrons to easily search for materials, check their borrowing status, and place reservations online. This improves accessibility by enabling users to interact with the library's resources remotely, saving time and effort. The system also facilitates personalized recommendations based on user preferences, enhancing their overall library experience.

3) Facilitating data-driven decision making

The library management system generates comprehensive reports and analytics on circulation patterns, popular titles, and more. These insights enable library administrators to make data-driven decisions regarding collection development, resource allocation, and service improvements. By understanding user needs and preferences, libraries can optimize their offerings and better serve their communities.

4) Contributing to the digital transformation of libraries

Implementing a library management system is a significant step towards the digital transformation of libraries. It prepares libraries to adapt to the changing needs of users in an increasingly digital world. By embracing technology and automating processes, libraries can enhance their relevance, attract new users, and position themselves as essential hubs for knowledge access and community engagement in the digital age.

1.6 Gantt Chart of Project Activities

TASK DESCRIPTION	WEEK 1	WEEK 2	WEEK 3	WEEK 4	WEEK 5	WEEK 6	WEEK 7	WEEK 8	WEEK 9	WEEK 10	WEEK 11	WEEK 12	WEEK 13	WEEK 14	WEEK 15
Assigning Student to Supervisors.															
Briefing of Workshop 1															
Discussion / Verification of tittle and synopsis															
Proposal Preparation															
Student submits proposal to Supervisor															
Discussion with Supervisor on analysis of the problem															
Project Implementation (Progress 1)															
Project Implementation (Progress 2)															
Project Implementation (Progress 3)															
Final Presentation															
Submission of Final Report															

CHAPTER 2: ANALYSIS OF PROBLEM

2.1 Problem Decomposition Description

1) Manual Book Tracking

In many libraries, book inventory is manually managed, often leading to significant issues such as errors in availability tracking, discrepancies in book status, and inefficient retrieval times. Libraries using manual systems can face difficulties ensuring real-time updates, resulting in double bookings, misplaced books, or slow responses to patron requests. The lack of automation significantly impacts both the user experience and library staff productivity.

2) Outdated Member Records

Manual management of library member information, including their borrowing history and overdue fines, often results in data inaccuracies. Without an automated system, member records can easily become outdated, leading to confusion over borrowing rights, overdue penalties, and lost or incorrect member contact details. This system not only makes managing large user bases difficult but also diminishes the overall reliability of library services.

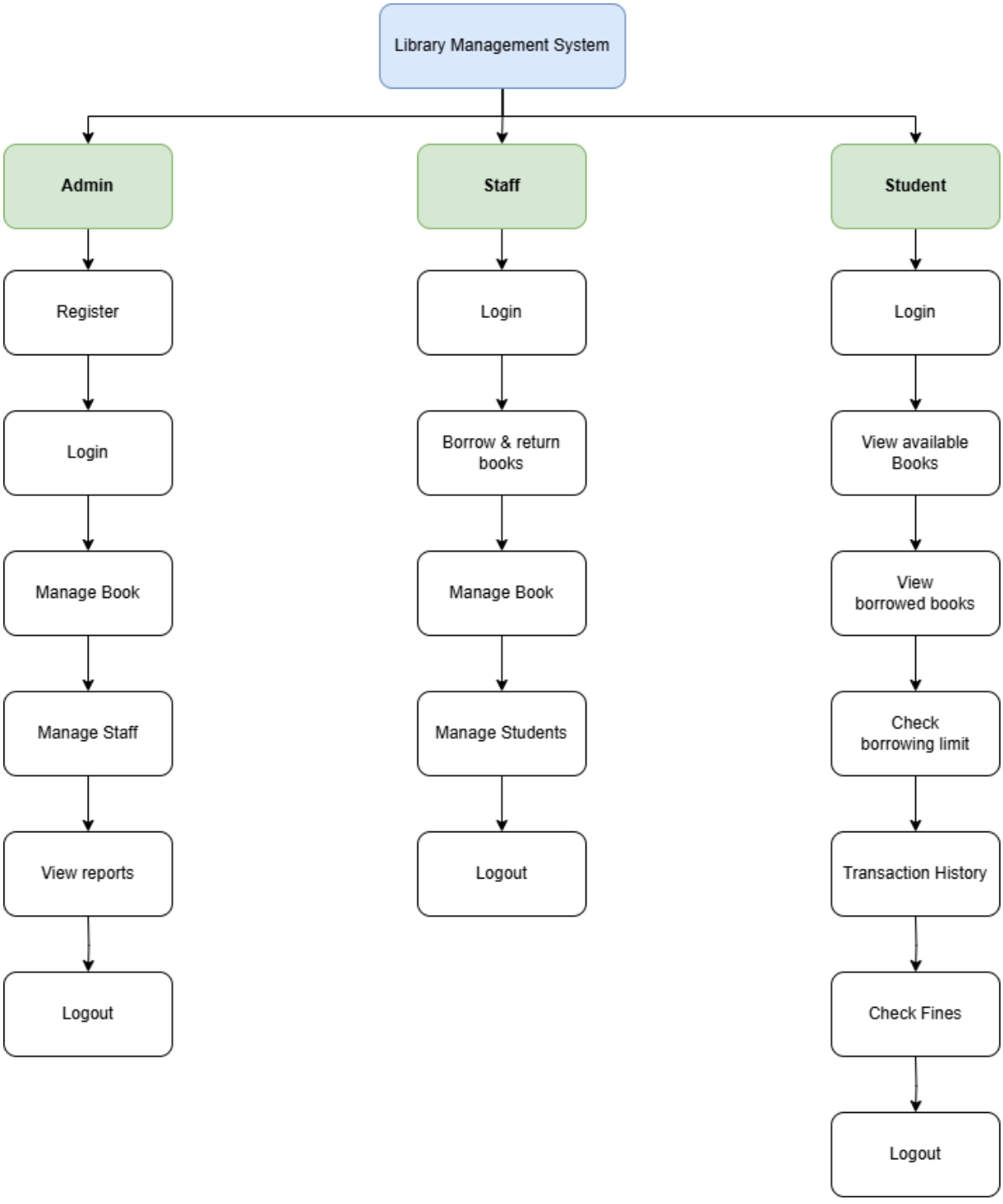
3) Inefficient Fine Calculations

Currently, libraries often struggle with calculating overdue fines manually, which can be time-consuming and prone to error. Without an automated method for calculating overdue fines, discrepancies can occur, leading to unfair penalties or lost revenue for the library. The manual tracking of fine statuses, combined with the irregular updating of records, can negatively affect both members and staff, causing dissatisfaction and operational inefficiencies.

4) Report Generation Challenges

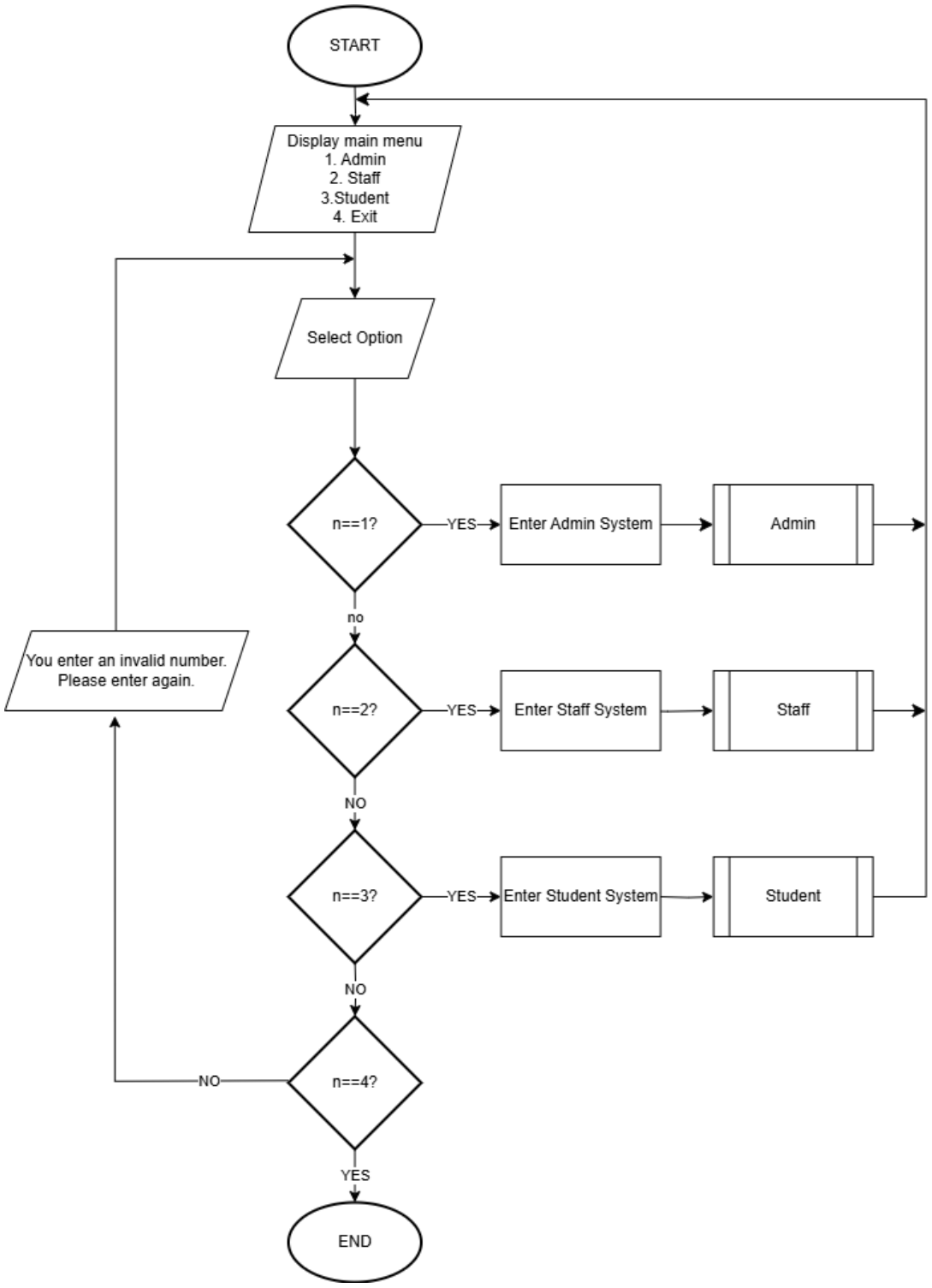
Generating accurate, up-to-date reports manually is both time-intensive and prone to error. Library staff often face delays in producing reports related to borrowing trends, overdue books, or inventory status. Without an automated system for generating these reports, libraries miss opportunities to use data effectively for decision-making. The lack of detailed and timely reports hampers strategic planning, resource allocation, and overall library management.

2.2 Structured Chart

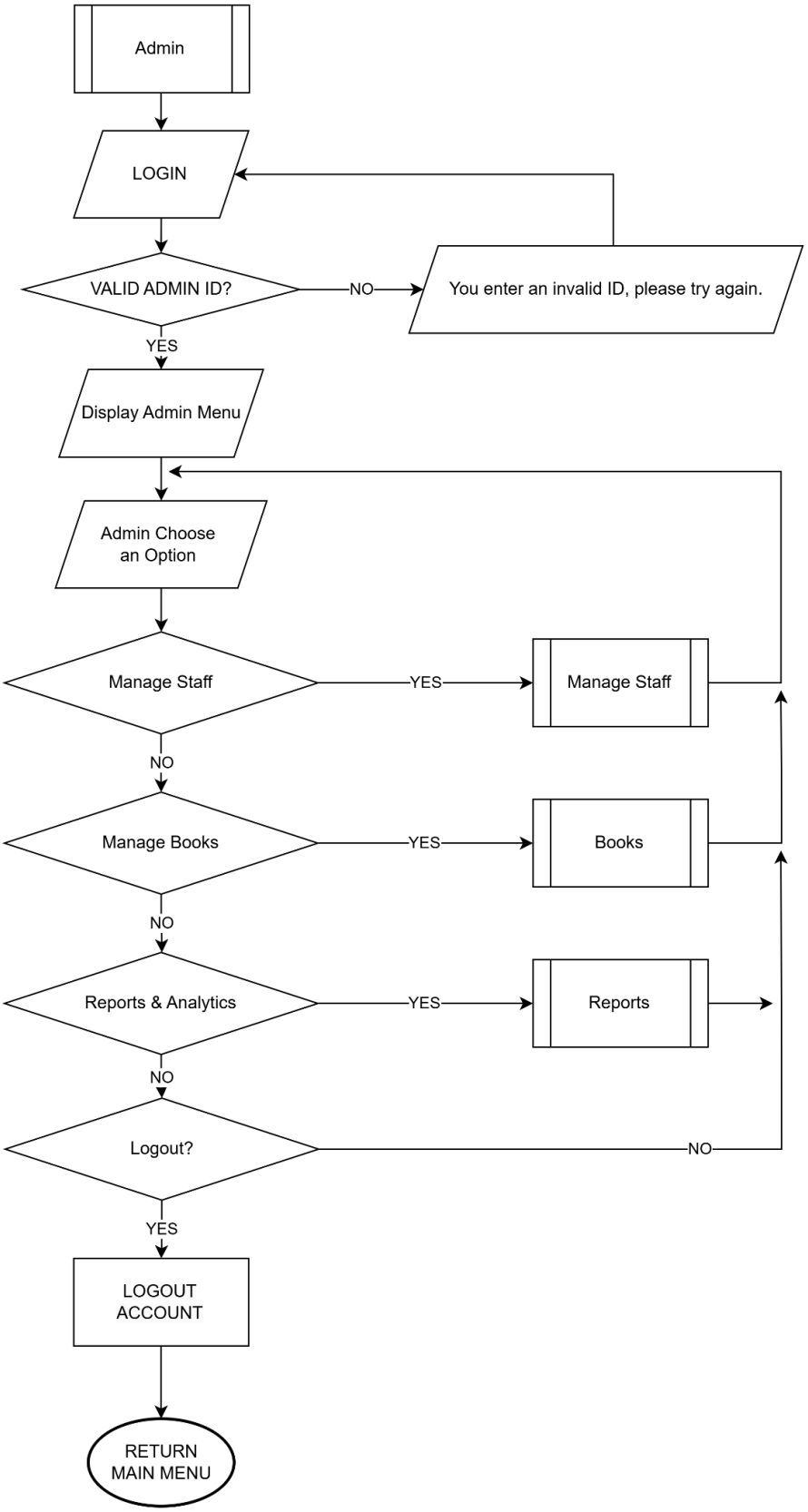


CHAPTER 3: DESIGN

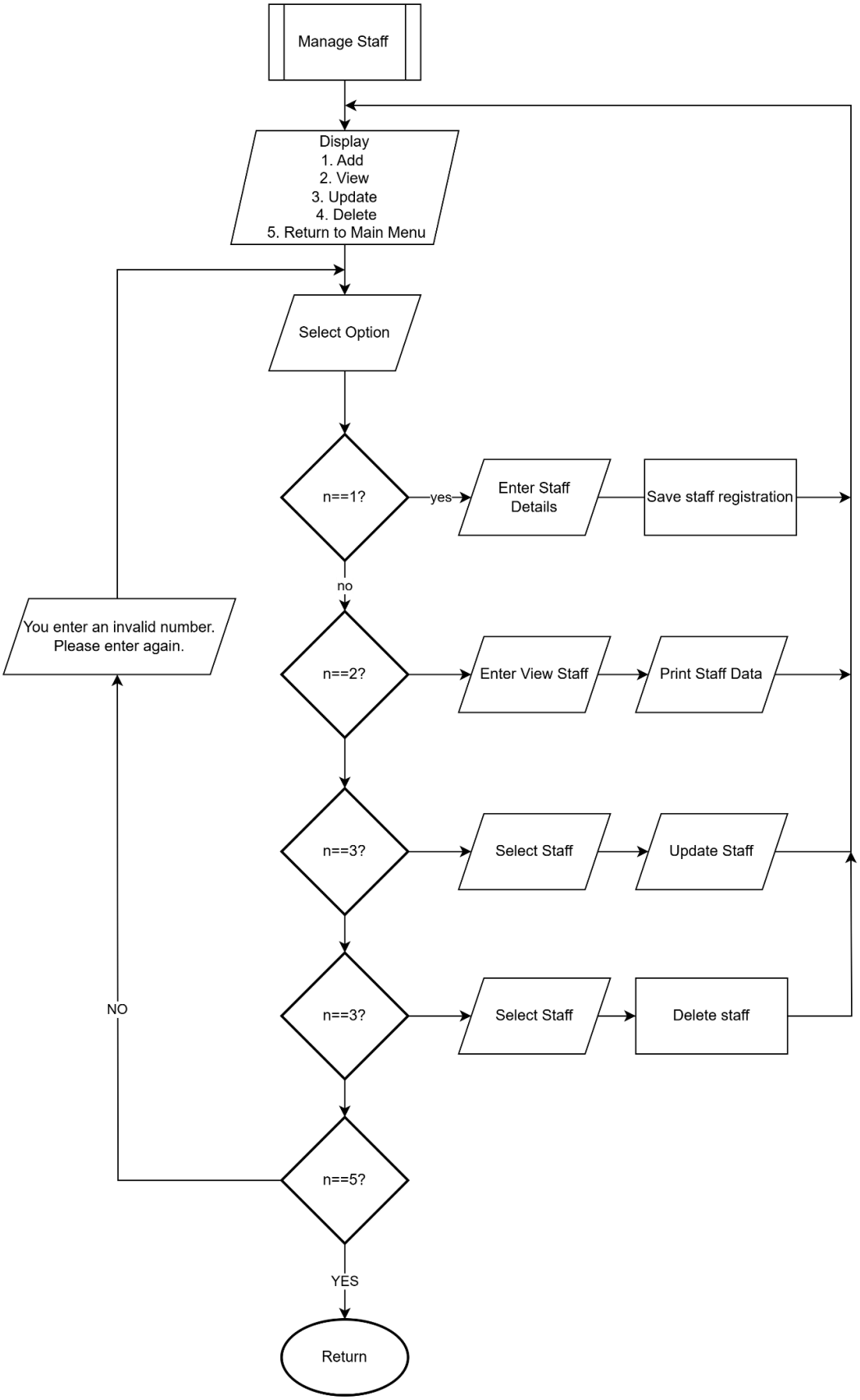
3.1 Flowchart



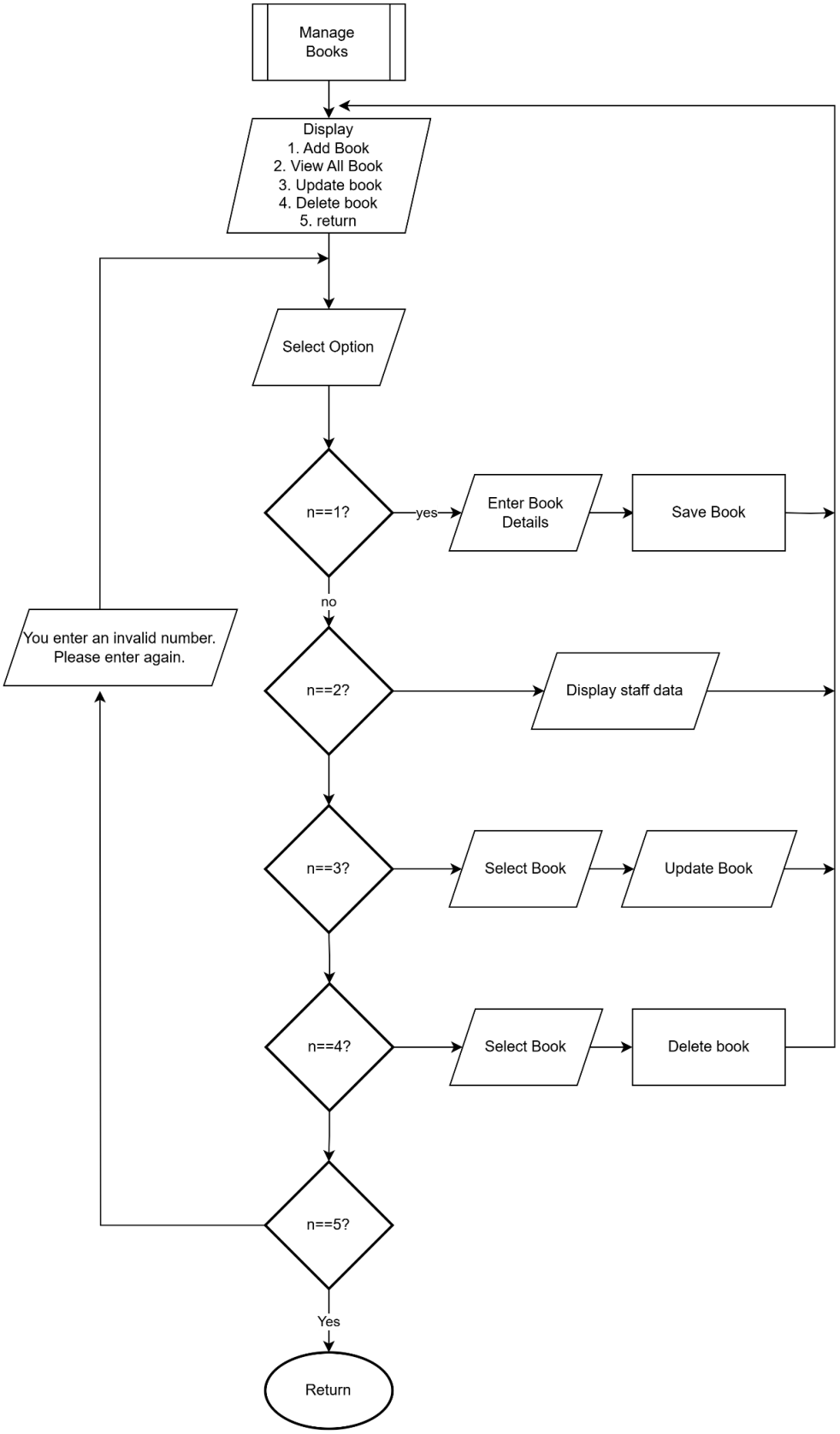
MAIN MENU



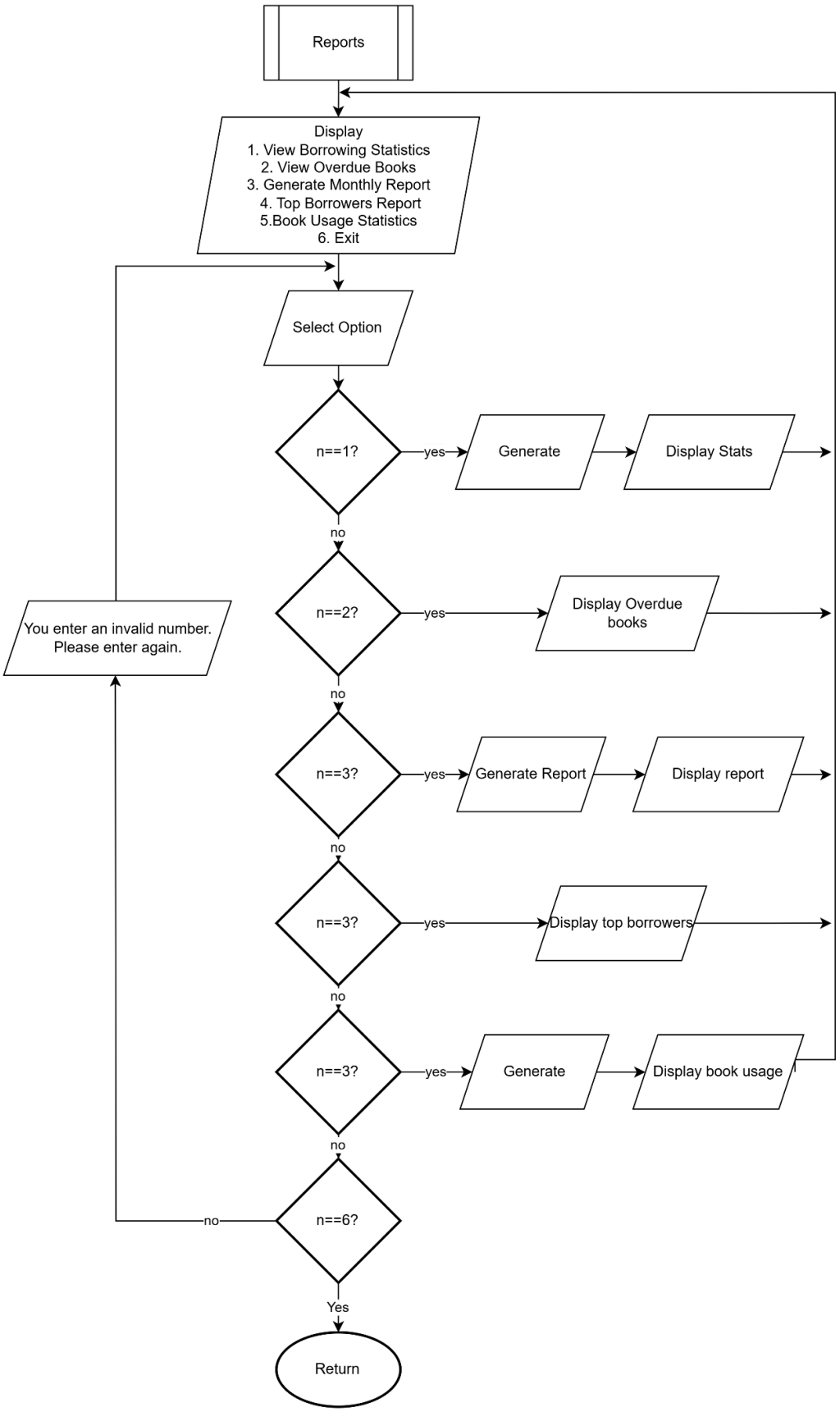
ADMIN FLOWCHART



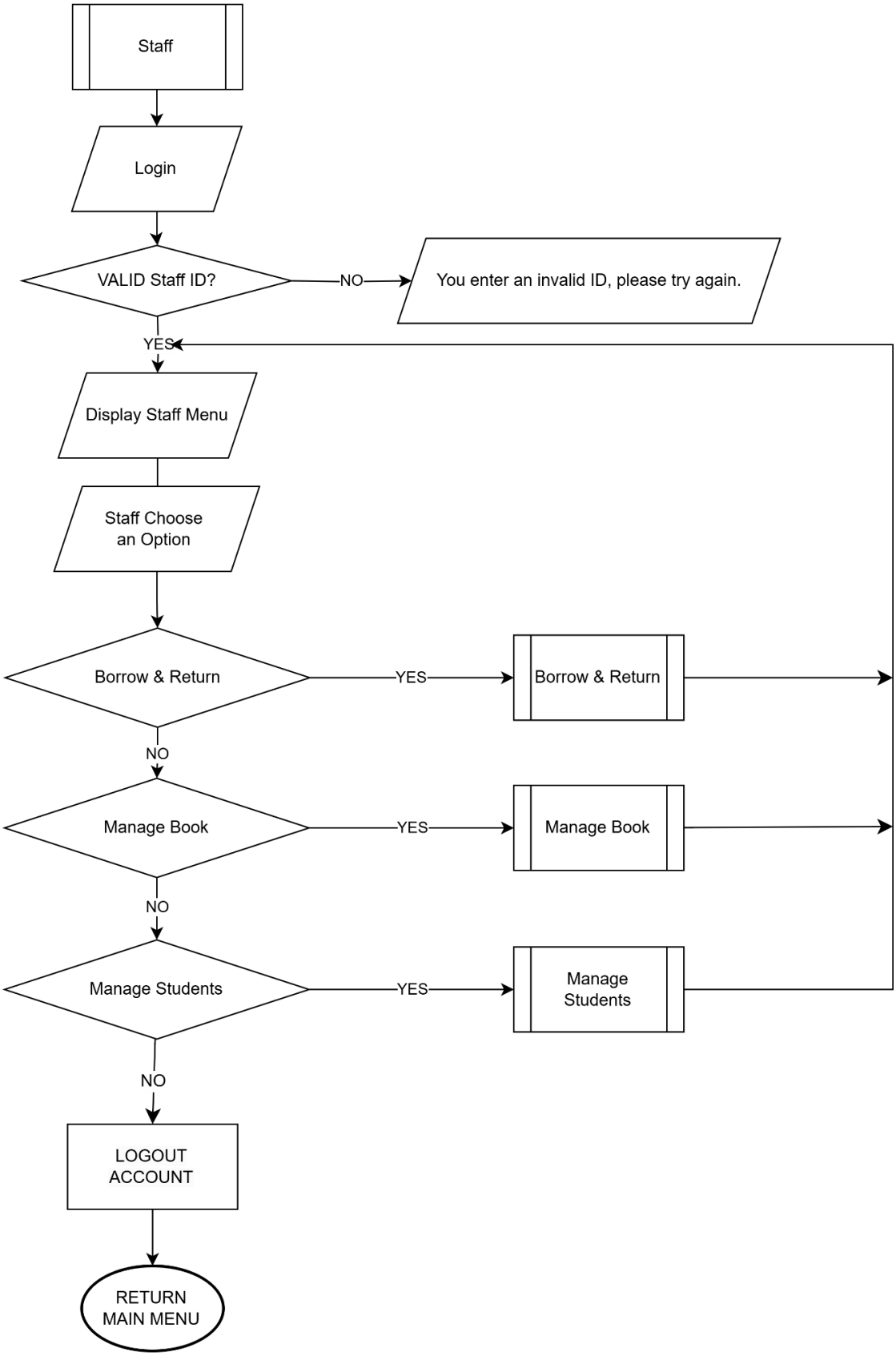
MANAGE STAFF FLOWCHART



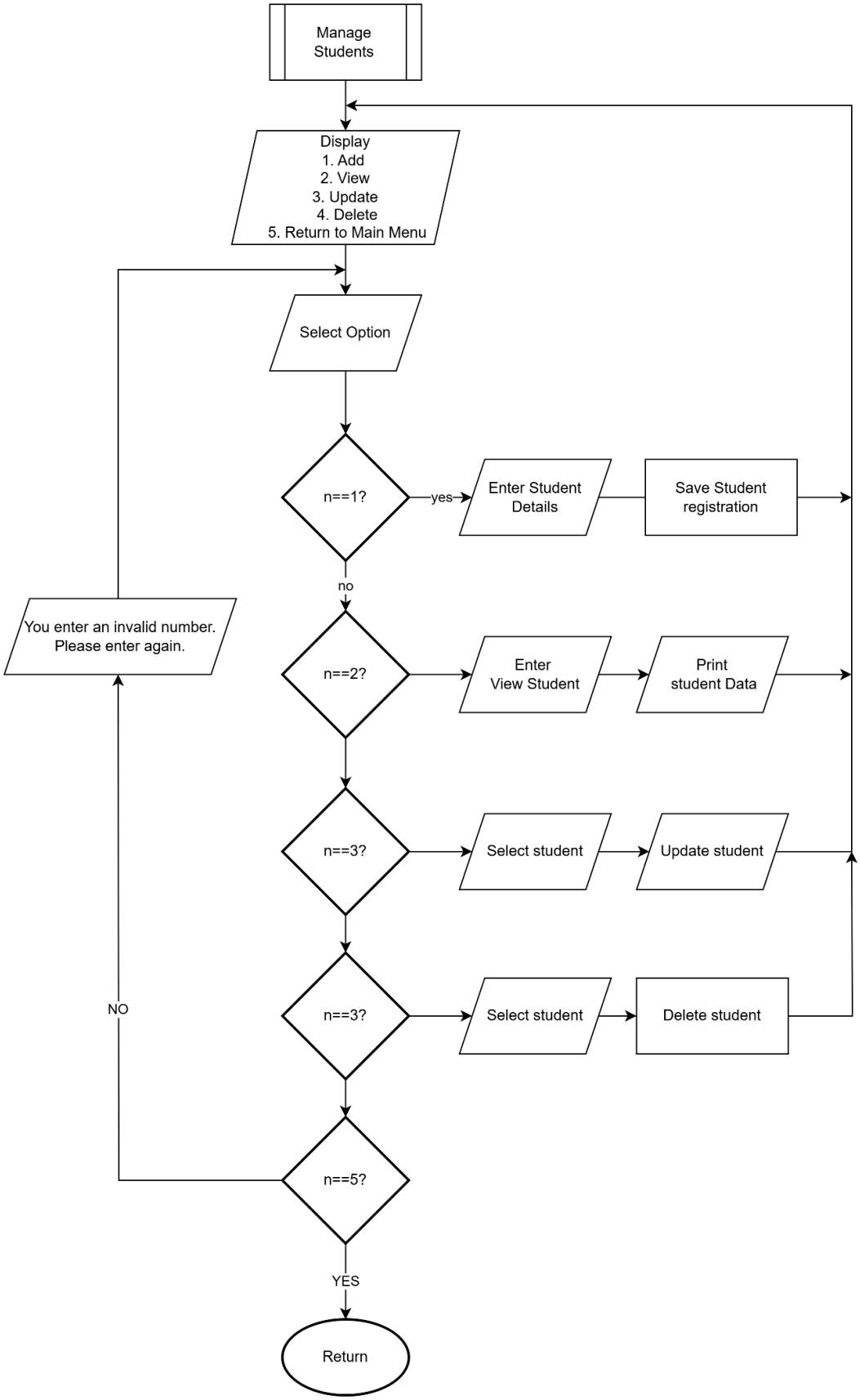
MANAGE BOOKS FLOWCHART



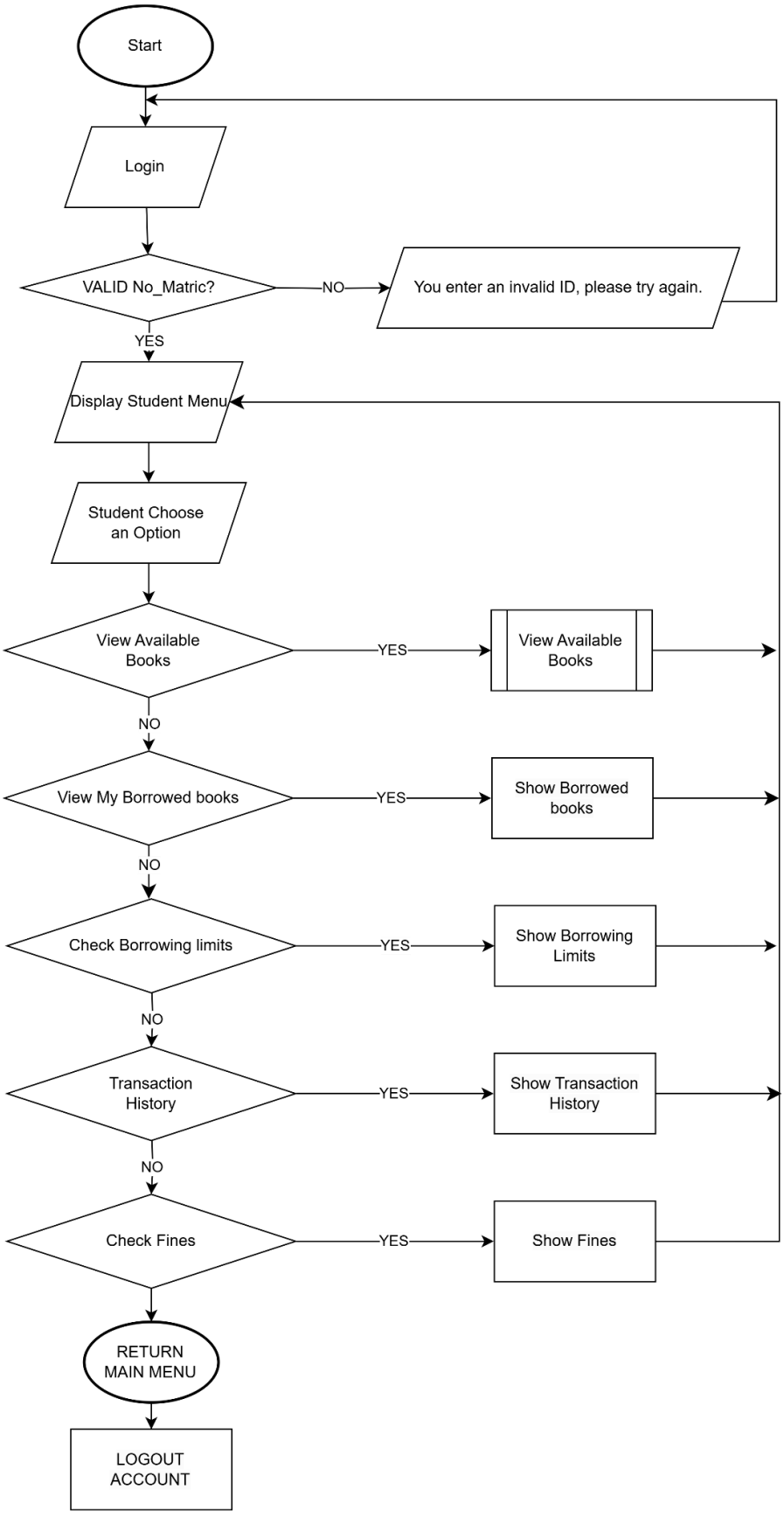
REPORTS FLOWCHART



STAFF FLOWCHART

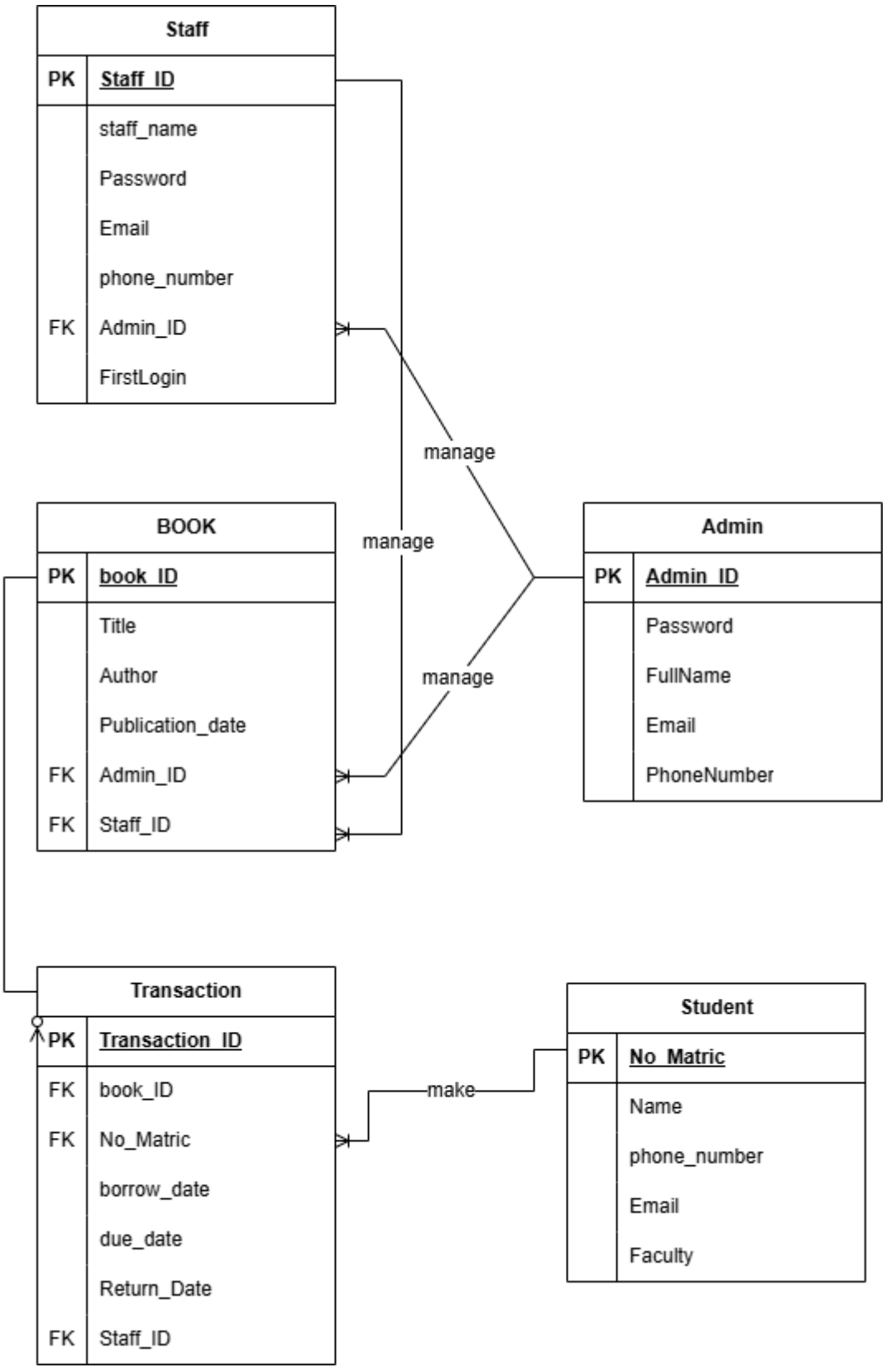


MANAGE STUDENTS FLOWCHART



STUDENTS FLOWCHART

3.2 ERD


Staff
PK
Staff_ID
staff_name
Password
Email
phone_number
FK
Admin_ID
FirstLogin
manage
manage
manage
BOOK
PK
book_ID
Title
Author
Publication_date
FK
Admin_ID
FK
Staff_ID
Admin
PK
Admin_ID
Password
FullName
Email
PhoneNumber
Transaction
PK
Transaction_ID
FK
book_ID
FK
No_Matric
borrow_date
due_date
Return_Date
FK
Staff_ID
make
Student
PK
No_Matric
Name
phone_number
Email
Faculty

3.3 Data Dictionary

ADMIN TABLE

ATTRIBUTE NAME	CONTENTS	DATA TYPE AND SIZE	FORMAT	RANGE	REQUIRED?	DEFAULT VALUE	UNIQUE?	PK OR FK	FK REFERENCED TABLE
Admin_ID	Unique admin identifier	varchar(10)	Alphanumeric	1-10 characters	Yes	None	Yes	PK	None
Password	Admin's password	varchar(255)	Alphanumeric	1-255 characters	Yes	None	No	None	None
FullName	Admin's full name	varchar(100)	Text	1-100 characters	Yes	None	No	None	None
Email	Admin's email address	varchar(100)	Email	1-100 characters	Yes	None	Yes	None	None
PhoneNumber	Admin's phone number	varchar(15)	Numeric	1-15 digits	No	None	No	None	None

STAFF TABLE

ATTRIBUTE NAME	CONTENTS	DATA TYPE AND SIZE	FORMAT	RANGE	REQUIRED?	DEFAULT VALUE	UNIQUE?	PK OR FK	FK REFERENCED TABLE
Staff_ID	Unique staff identifier	varchar(10)	Alphanumeric	1-10 characters	Yes	None	Yes	PK	None
FullName	Staff's full name	varchar(100)	Text	1-100 characters	Yes	None	No	None	None
Email	Staff's email address	varchar(100)	Email	1-100 characters	Yes	None	Yes	None	None
PhoneNumber	Staff's phone number	varchar(15)	Numeric	1-15 digits	No	None	No	None	None
Role	Staff's role in the system	varchar(50)	Text	1-50 characters	Yes	None	No	None	None

STUDENT TABLE

ATTRIBUTE NAME	CONTENTS	DATA TYPE AND SIZE	FORMAT	RANGE	REQUIRED?	DEFAULT VALUE	UNIQUE?	PK OR FK	FK REFERENCED TABLE
Student_ID	Unique student identifier	varchar(10)	Alphanumeric	1-10 characters	Yes	None	Yes	PK	None
FullName	Student's full name	varchar(100)	Text	1-100 characters	Yes	None	No	None	None
Email	Student's email address	varchar(100)	Email	1-100 characters	Yes	None	Yes	None	None
PhoneNumber	Student's phone number	varchar(15)	Numeric	1-15 digits	No	None	No	None	None

EnrollmentDate	Date of enrollment	DATE	Date	YYYY-MM-DD	Yes	CURRENT_DATE	No	None	None

BOOK TABLE

ATTRIBUTE NAME	***CONTENTS***	***DATA TYPE AND SIZE***	***FORMAT***	***RANGE***	***REQUIRED?***	***DEFAULT VALUE***	***UNIQUE?***	***PK OR FK***	***FK REFERENCED TABLE***
Book_ID	Unique book identifier	varchar(13)	Alphanumeric	1-13 characters	Yes	None	Yes	PK	None
Title	Book's title	varchar(255)	Text	1-255 characters	Yes	None	No	None	None
Author	Author(s) of the book	varchar(255)	Text	1-255 characters	Yes	None	No	None	None
ISBN	Book ISBN	varchar(20)	Alphanumeric	1-20 characters	Yes	None	Yes	None	None
Category	Book's category	varchar(50)	Text	1-50 characters	Yes	None	No	None	None
Quantity	Number of available copies	INT	Integer	0-9999	Yes	0	No	None	None

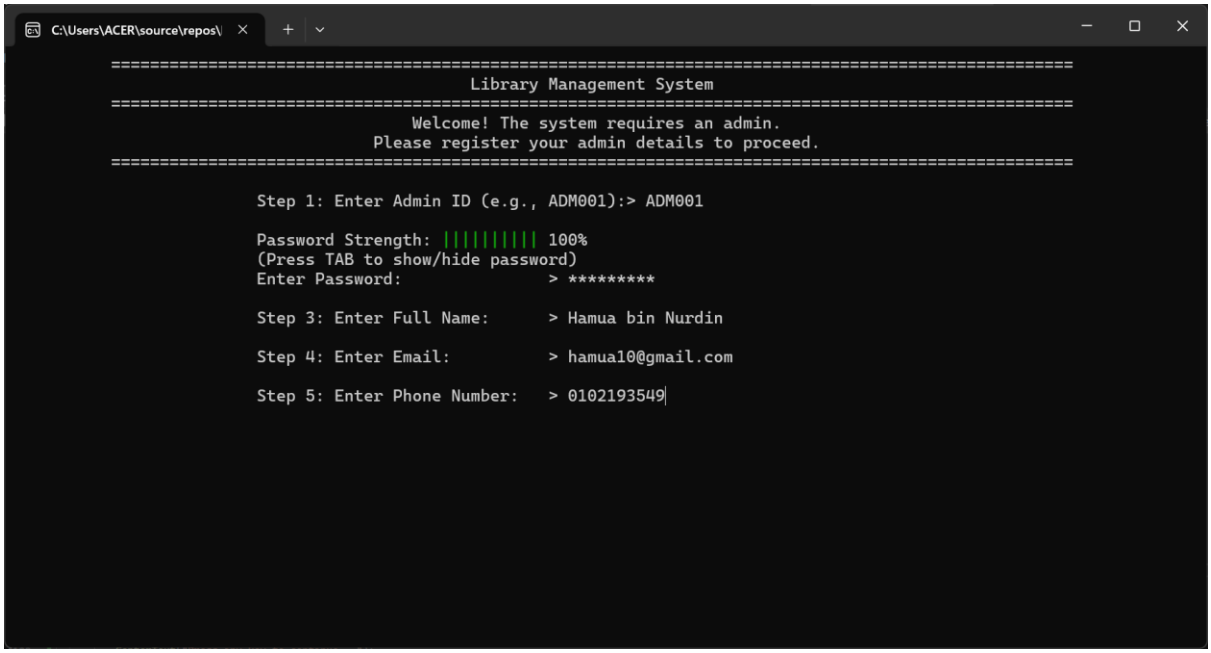
TRANSACTION TABLE

ATTRIBUTE NAME	***CONTENTS***	***DATA TYPE AND SIZE***	***FORMAT***	***RANGE***	***REQUIRED?***	***DEFAULT VALUE***	***UNIQUE?***	***PK OR FK***	***FK REFERENCED TABLE***
Transaction_ID	Unique transaction ID	INT	Integer	1-999999	Yes	None	Yes	PK	None
Book_ID	Book ID borrowed	varchar(13)	Alphanumeric	1-13 characters	Yes	None	No	FK	book
Student_ID	Student who borrowed book	varchar(10)	Alphanumeric	1-10 characters	Yes	None	No	FK	student
Borrow_Date	Date book was borrowed	DATE	Date	YYYY-MM-DD	Yes	CURRENT_DATE	No	None	None
Return_Date	Date book was returned	DATE	Date	YYYY-MM-DD	No	NULL	No	None	None
Fine	Fine for overdue books	DECIMAL(10, 2)	Numeric	0.00-9999.99	No	0	No	None	None

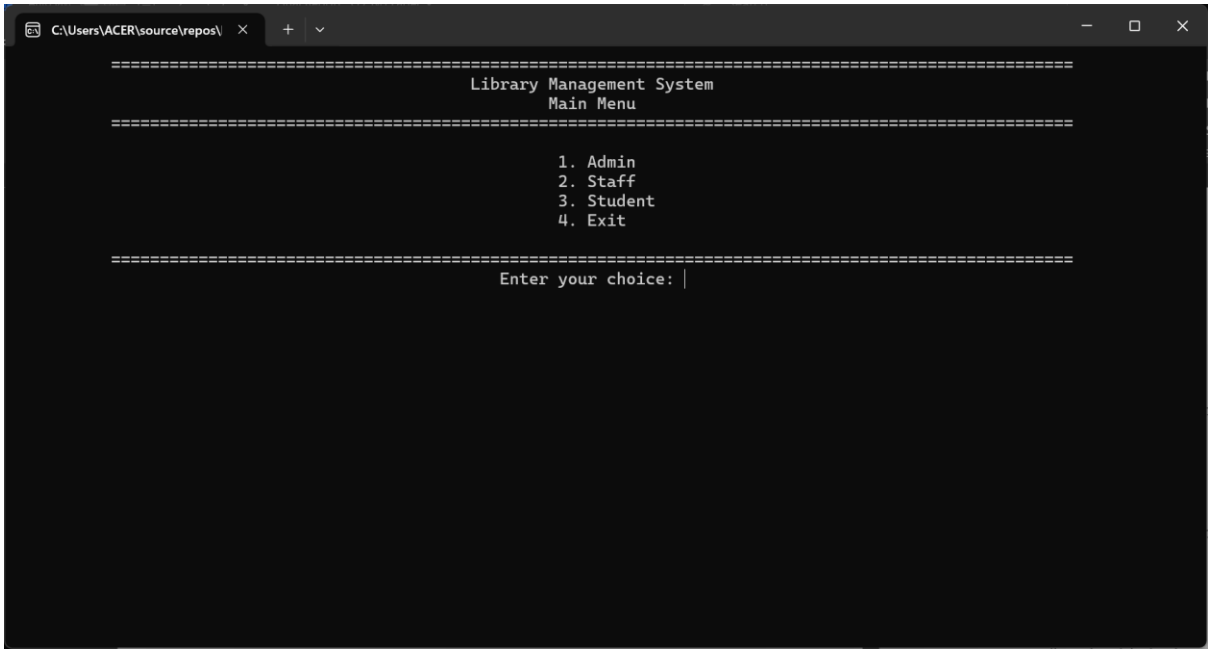
3.4 Interface Design

ADMIN

Register Admin

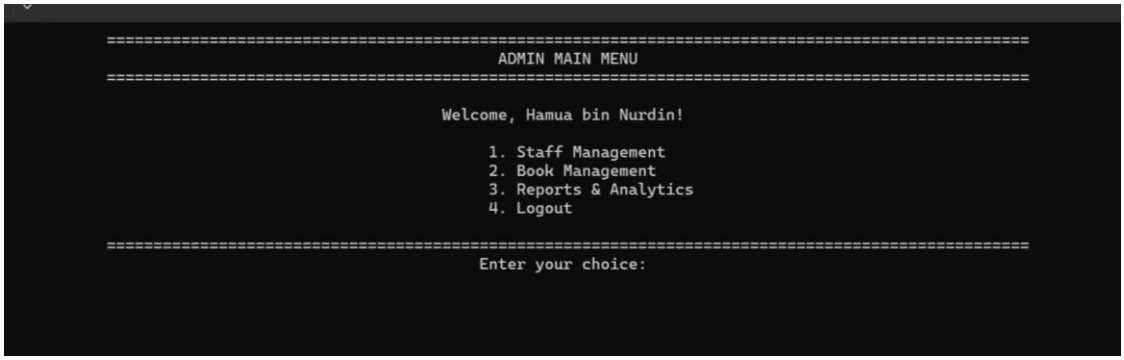


MAIN MENU



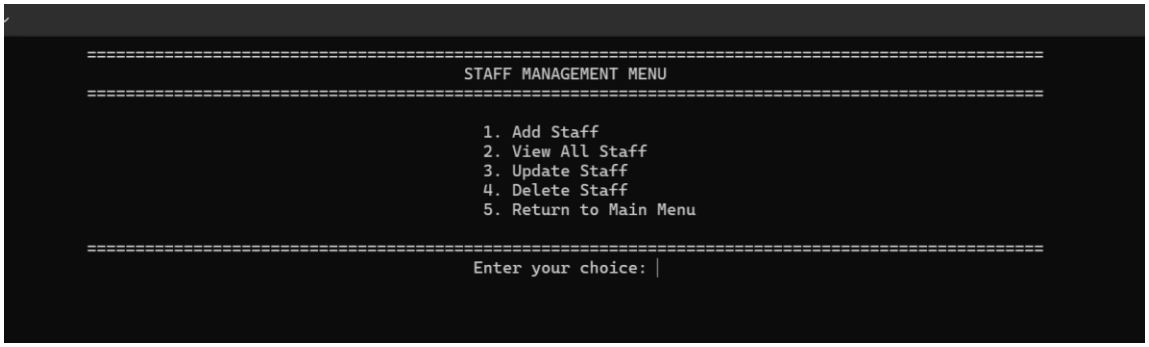


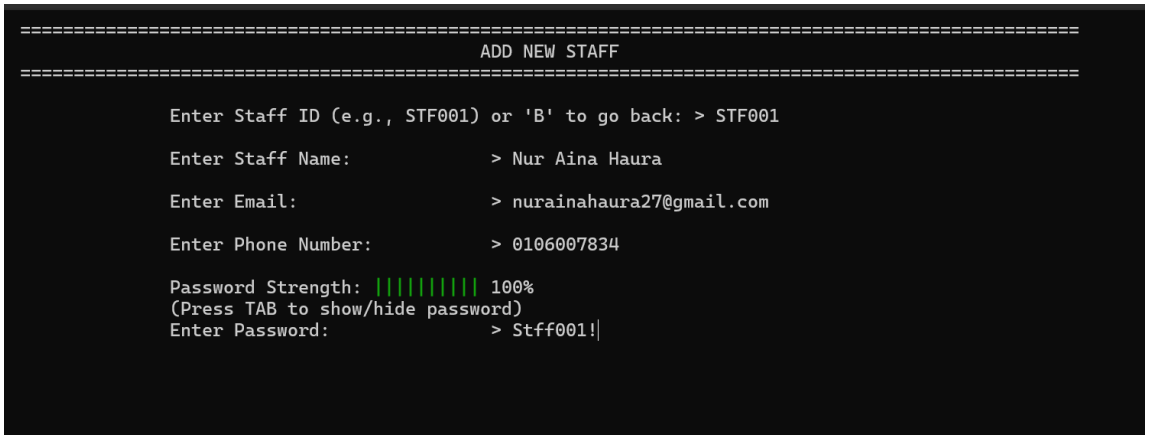
ADMIN LOGIN



ADMIN MENU

ADMIN MENU - STAFF MANAGEMENT MENU





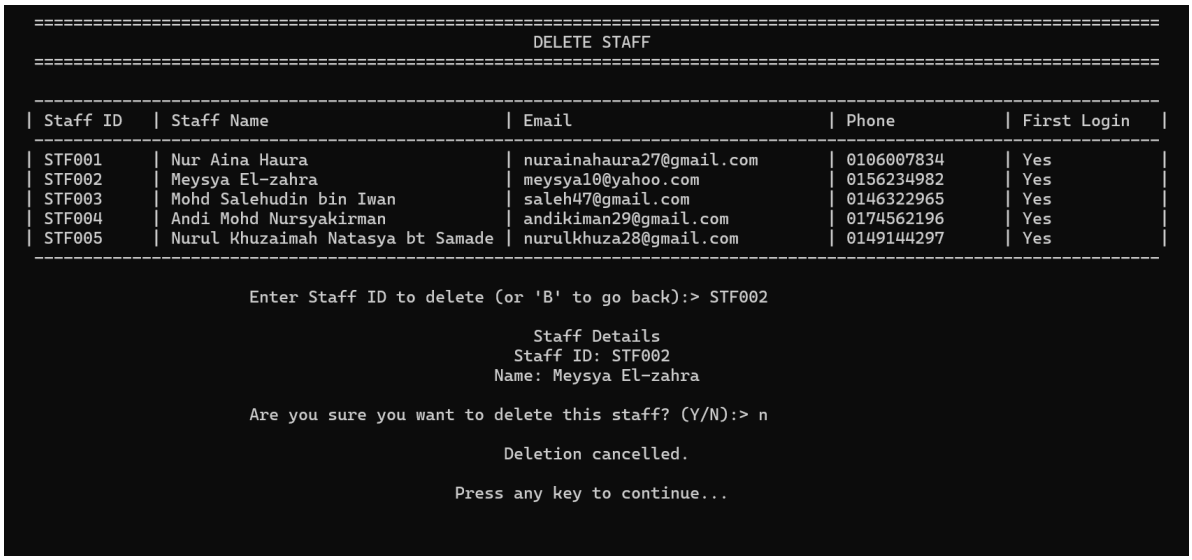
ADMIN MENU – STAFF MANAGEMENT(ADD)



ADMIN MENU – STAFF MANAGEMENT(ADD CONFIRMATION)

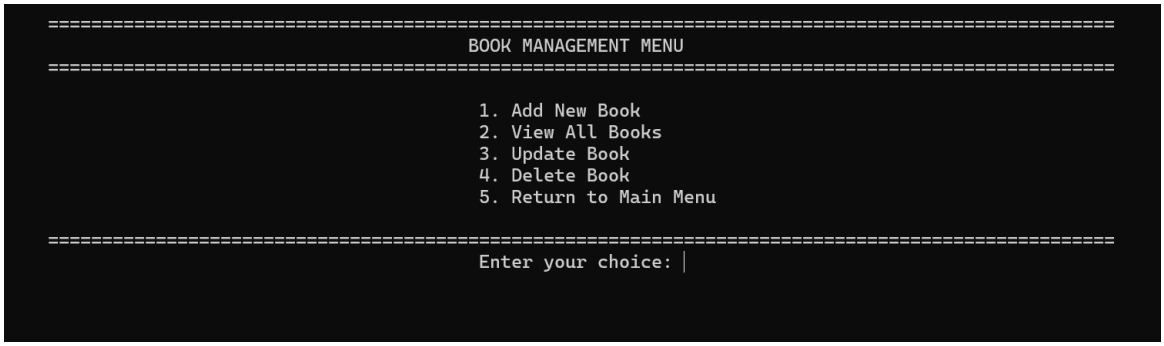


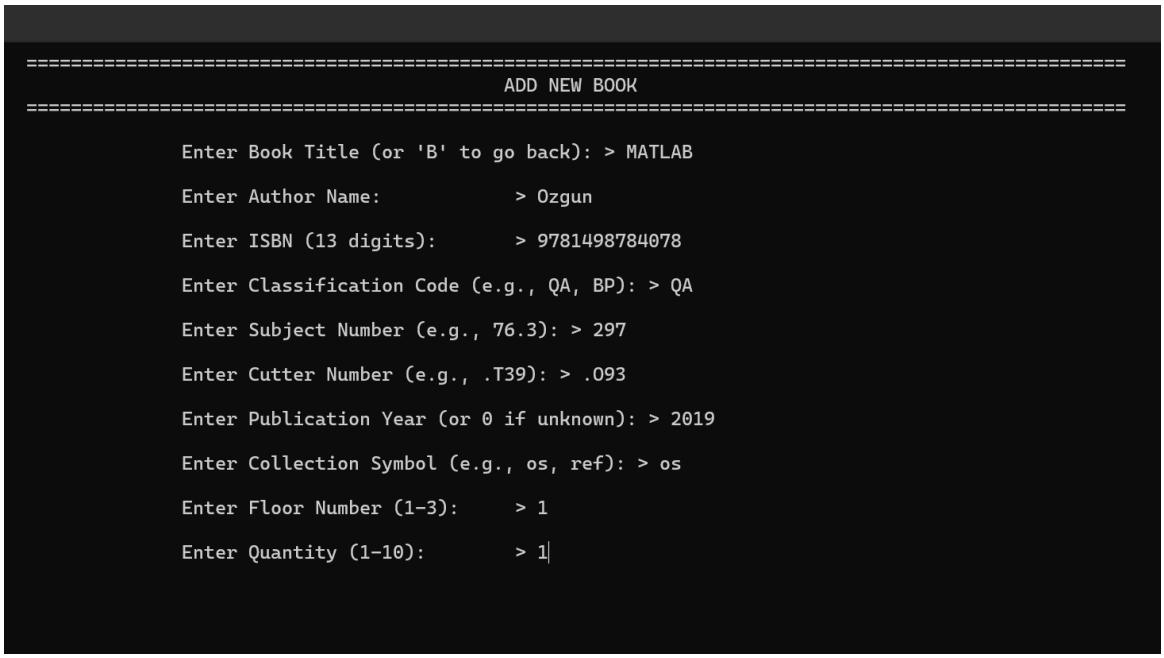
ADMIN MENU – STAFF MANAGEMENT (VIEW)



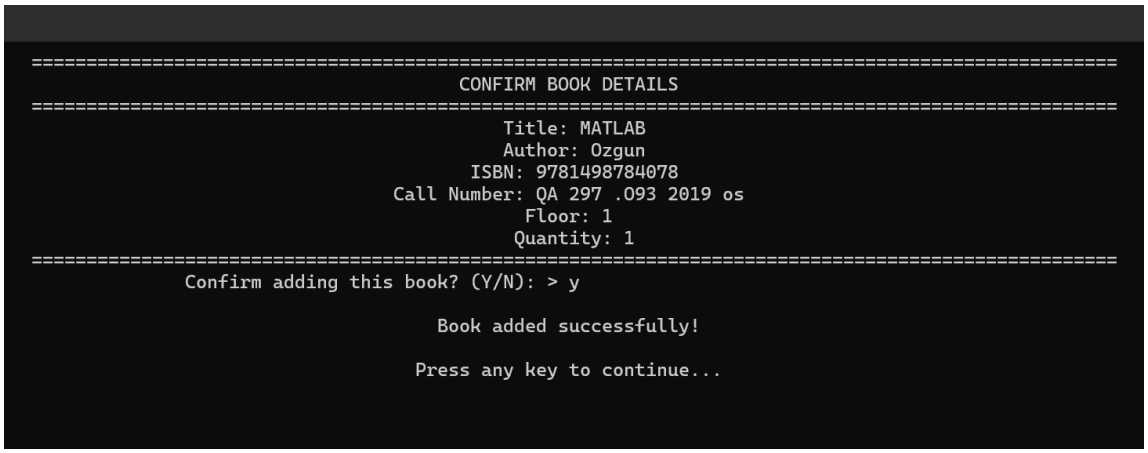
ADMIN MENU – STAFF MANAGEMENT(DELETE)

BOOK MANAGEMENT MENU

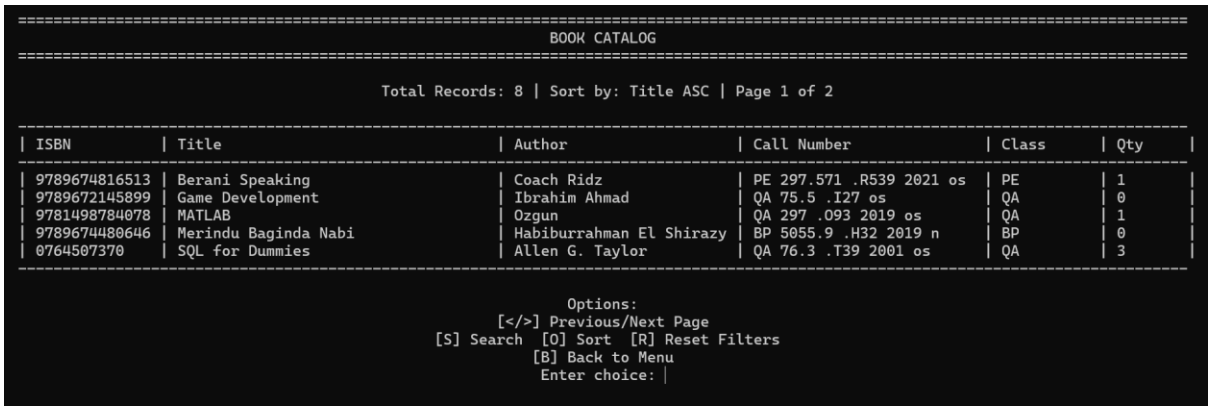




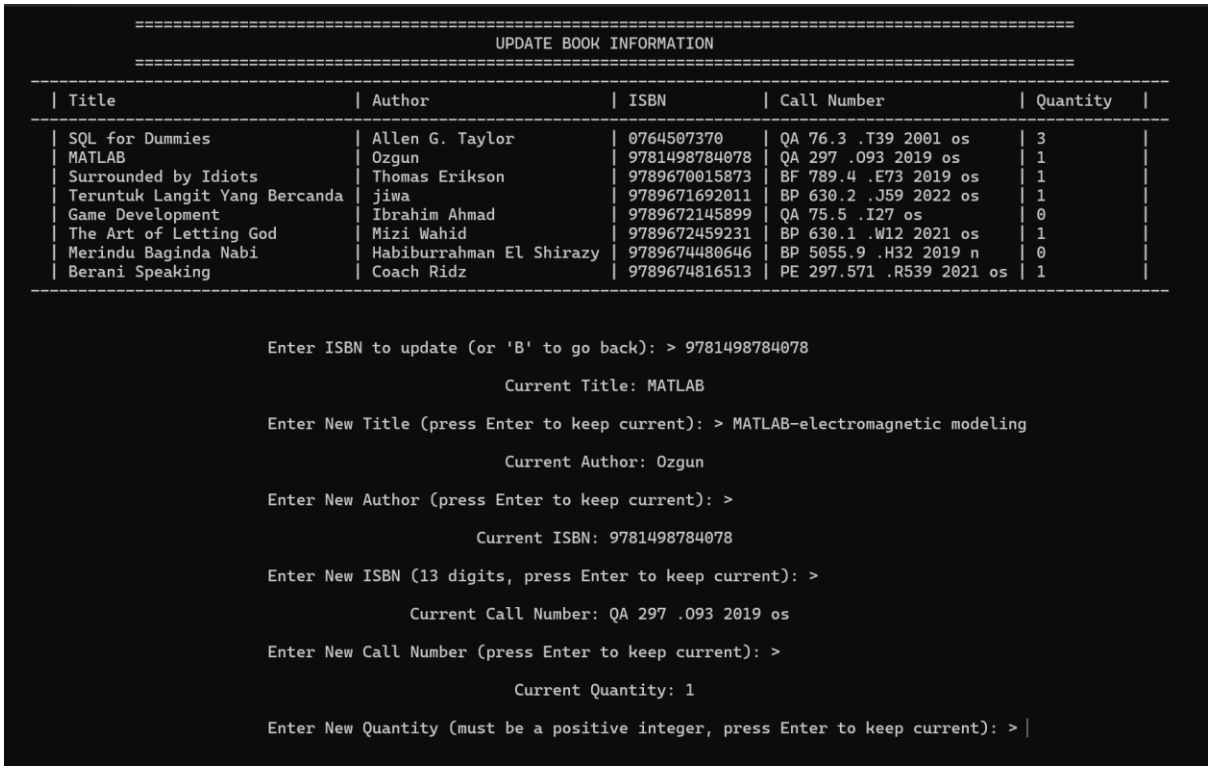
ADMIN MENU – BOOK MANAGEMENT (ADD)



ADMIN MENU – BOOK MANAGEMENT (ADD CONFIRMATION)



ADMIN MENU – BOOK MANAGEMENT (VIEW)



ADMIN MENU – BOOK MANAGEMENT (UPDATE)

```
================================================================================================
                                        CONFIRM UPDATE
================================================================================================

                                    ISBN: 9781498784078
                            New Title: MATLAB-electromagnetic modeling
                                    New Author: Ozgun
                                New ISBN: 9781498784078
                            New Call Number: QA 297 .O93 2019 os
                                    New Quantity: 1
================================================================================================
              Confirm update? (Y/N):        > y

                                Book information updated successfully!

                                     Press any key to continue...
```

ADMIN MENU – BOOK MANAGEMENT (UPDATE CONFIRMATION)

```
================================================================================================
                                        DELETE BOOK
================================================================================================
              Enter ISBN to delete (13 digits) or 'B' to go back: > 9781498784078
              Are you sure you want to delete this book? (Y/N): > y
                                    Book deleted successfully!

                                   Press any key to continue...
```

ADMIN MENU – BOOK MANAGEMENT (DELETE)

REPORTS AND ANALYTICS

```
================================================================================================
                                      REPORTS & ANALYTICS
================================================================================================

                                    1. View Borrowing Statistics
                                    2. View Overdue Books
                                    3. Generate Monthly Report
                                    4. Top Borrowers Report
                                    5. Book Usage Statistics
                                    6. Return to Main Menu

================================================================================================
                                      Enter your choice:
```

STAFF MENU

```
================================================================================================
                                        Staff Login
================================================================================================

            Enter Staff ID:              > STF001

            (Press TAB to show/hide password)
            Enter Password:              > ********
```

STAFF LOGIN

```
================================================================================================
                                    Staff Login
================================================================================================

                First login detected. Please reset your password.

           (Min 8 chars, 1 uppercase, 1 lowercase, 1 digit, 1 special)

     Password Strength: |||||||||| 100%
     (Press TAB to show/hide password)
     Enter Password:               > Nuraina2004!

     (Press TAB to show/hide password)
     Enter Password:               > Nuraina2004!
       Password reset successfully! Please log in with your new password.
```

RESET PASSWORD FOR FIRST TIME LOGIN

```
================================================================================================
                                        STAFF MENU
================================================================================================

                                   1. Borrow & Return Books
                                   2. Manage Books
                                   3. Manage Students
                                   4. Logout

================================================================================================
                                    Enter your choice:
```

STAFF MENU

```
================================================================================================
                                    BORROW & RETURN BOOKS
================================================================================================

                                        1. Borrow Book
                                        2. Return Book
                                        3. Back to Main Menu

================================================================================================
                                    Enter your choice:
```

STAFF MENU – BORROW & RETURN BOOKS

```
================================================================================================
                                        BORROW A BOOK
================================================================================================

            Enter Student Matric Number (or 'B' to go back): > B032310741
```

STAFF MENU – BORROW & RETURN BOOKS (BORROW BOOKS), ENTER STUDENT MATRIC NUMBER

```
================================================================================================
                                      STUDENT INFORMATION
================================================================================================
                                    Name: Riswan bin Hamua
                                        Faculty: FTMK
                                   Current Borrowed Books: 0
================================================================================================

            Enter Book ISBN (or 'B' to go back): >
```

STAFF MENU – BORROW & RETURN BOOKS(ENTER BOOK ISBN)

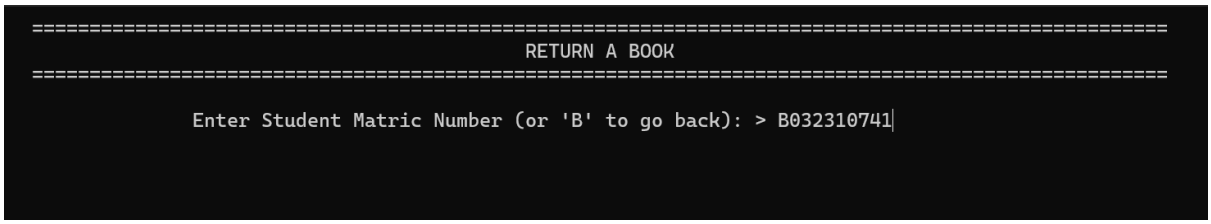
```
================================================================================================
                                      CONFIRM BORROWING
================================================================================================
                                    Book Title: MATLAB
                                       Author: Ozgun
                                    Available Copies: 1
================================================================================================

            Confirm borrowing? (Y/N):     > y

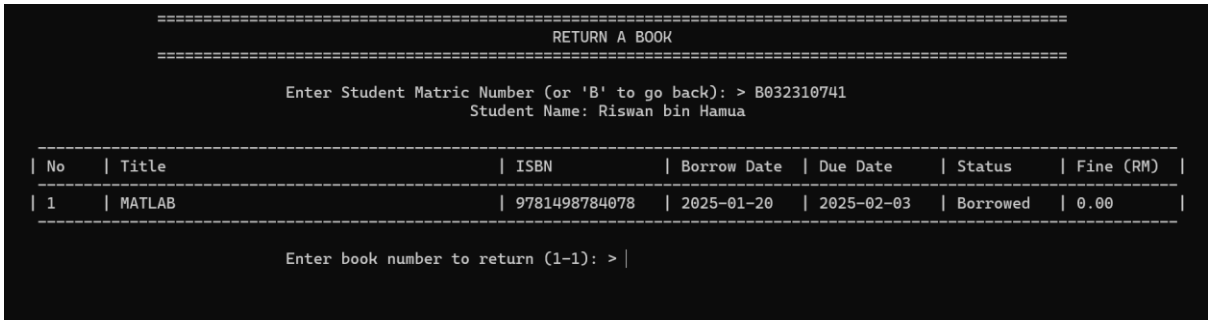
                                Book borrowed successfully!
                        Please return the book within 14 days to avoid fines.

                                Press any key to continue...
```

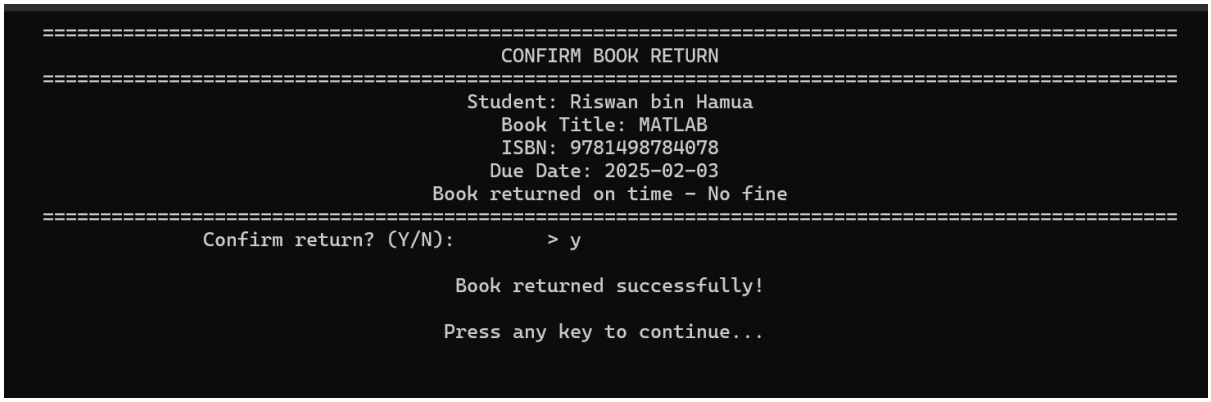
STAFF MENU – BORROW & RETURN BOOKS (BORROW BOOK CINFIRMATION)



STAFF MENU – BORROW & RETURN BOOKS (RETURN BOOKS), ENTER STUDENT MATRIC NUMBER



STAFF MENU – BORROW & RETURN BOOKS(ENTER BOOK NUMBER)



STAFF MENU – BORROW & RETURN BOOKS (RETURN BOOK CINFIRMATION)

```
================================================================================
                              MANAGE STUDENTS
================================================================================

                              1. Add New Student
                              2. View All Students
                              3. Update Student
                              4. Delete Student
                              5. Return to Main Menu

================================================================================
                              Enter your choice:
```

STAFF MENU – MANAGE STUDENT MENU

```
================================================================================
                              ADD NEW STUDENT
================================================================================
          Enter Matric Number (or 'B' to go back): >
Error: Matric Number cannot be empty.
          Enter Matric Number (or 'B' to go back): > B032310583
          Enter Student Name:           > LOW XIN YEE
          Enter Phone Number:           > 0173269844
          Enter Email:                  >  B032310583@student.utem.edu.my
          Enter Faculty:                > FTMK
```

STAFF MENU – MANAGE STUDENT (ADD)

```
================================================================================
                           CONFIRM STUDENT DETAILS
================================================================================
                           Matric Number: B032310583
                               Name: LOW XIN YEE
                               Phone: 0173269844
                        Email: B032310583@student.utem.edu.my
                                  Faculty: FTMK
================================================================================
        Confirm adding this student? (Y/N): > y

                           Student added successfully!

                          Press any key to continue...
```

STAFF MENU – MANAGE STUDENT (ADD CONFIRMATION)

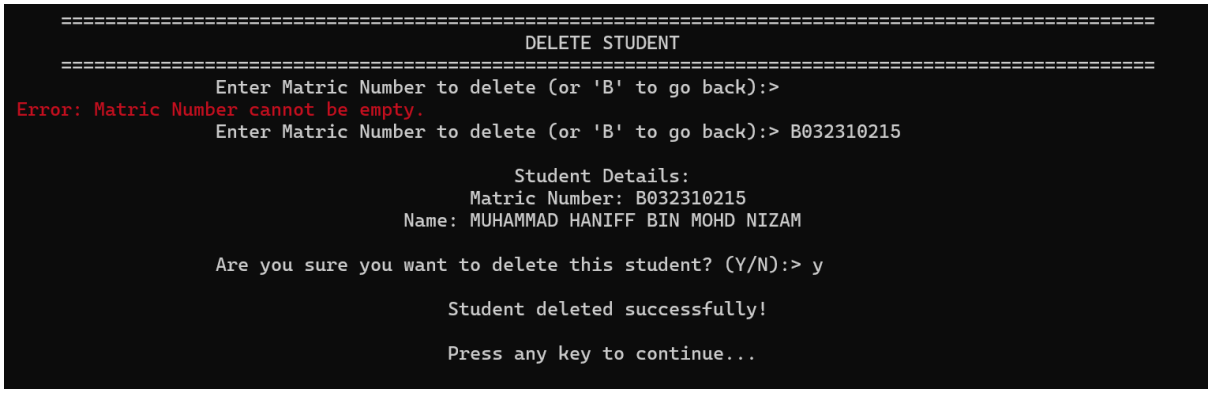
```
================================================================================
                              STUDENT RECORDS
================================================================================

                    Total Records: 8 | Sort by: No_Matric ASC | Page 1 of 2

--------------------------------------------------------------------------------
 | Matric No   | Name                          | Email                     | Phone       | Faculty |
--------------------------------------------------------------------------------
 | B032220056  | HMAM NOORELDEEN ABDALLA ALTOOM | hmam@gmail.com            | 123456789   | FTMK    |
 | B032310202  | MUHAMMAD HAZIQ BIN MOHD AZHAR  | haziq@gmail.com           | 172467277   | FTMK    |
 | B032310215  | MUHAMMAD HANIFF BIN MOHD NIZAM | hanif@gmail.com           | 123456342   | FTMK    |
 | B032310420  | MUHAMMAD AKHMAL BIN ROSLAN     | akhmal@yahoo.com          | 138782670   | FTMK    |
 | B032310583  | LOW XIN YEE                    | B032310583@student.utem.edu.my | 173269844 | FTMK    |
--------------------------------------------------------------------------------

                                  Options:
                              [</>] Previous/Next Page
                    [S] Search  [O] Sort  [R] Reset Filters
                              [B] Back to Menu
                               Enter choice:
```

STAFF MENU – MANAGE STUDENT (VIEW)



STAFF MENU – MANAGE STUDENT (DELETE)

STUDENT

```
================================================================================================================
                                                Student Login
================================================================================================================


                Enter Matric Number (or 'B' to go back):> B032310741
```

STUDENT LOGIN

```
================================================================================================================
                                               STUDENT PORTAL
================================================================================================================

                                          Welcome, Riswan bin Hamua

                                          1. View Available Books
                                          2. View My Borrowed Books
                                          3. Check Borrowing Limits
                                          4. Search Transaction History
                                          5. Check Fines
                                          6. Back to Main Menu

================================================================================================================
                                             Enter your choice:
```

STUDENT MENU

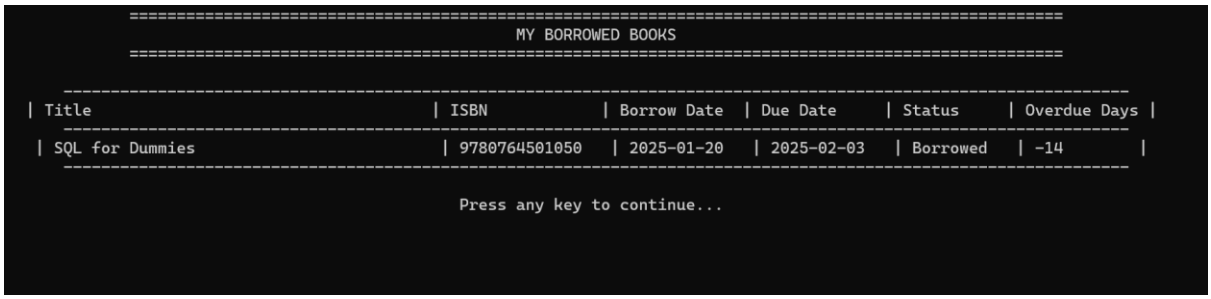
```
================================================================================================================
                                                AVAILABLE BOOKS
================================================================================================================

                                  Total Available Books: 6 | Sort by: Title ASC | Page 1 of 2

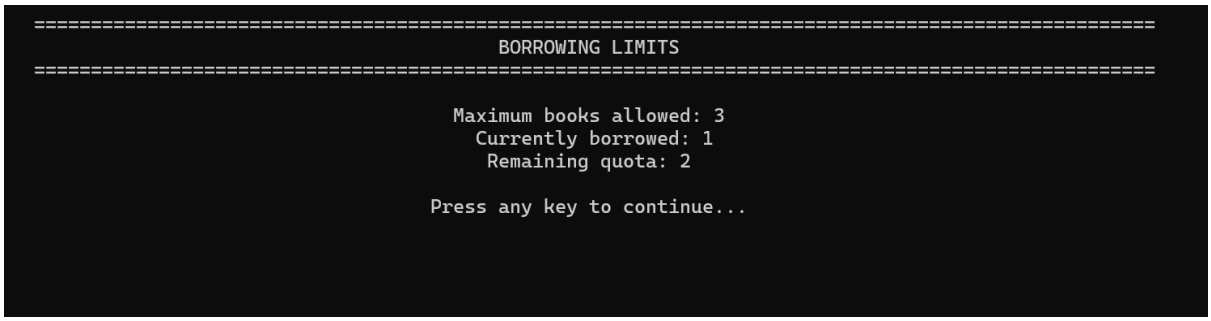
----------------------------------------------------------------------------------------------------------------
| ISBN           | Title                        | Author              | Call Number                  | Class    | Qty   |
----------------------------------------------------------------------------------------------------------------
| 9789674816513  | Berani Speaking              | Coach Ridz          | PE 297.571 .R539 2021 os     | PE       | 1     |
| 9781498784078  | MATLAB                       | Ozgun               | QA 297 ..093 2019 os         | QA       | 1     |
| 0764507370     | SQL for Dummies              | Allen G. Taylor     | QA 76.3 .T39 2001 os         | QA       | 3     |
| 9789670015873  | Surrounded by Idiots         | Thomas Erikson      | BF 789.4 .E73 2019 os        | BF       | 1     |
| 9789671692011  | Teruntuk Langit Yang Bercanda | jiwa               | BP 630.2 .J59 2022 os        | BP       | 1     |
----------------------------------------------------------------------------------------------------------------

                                                  Options:
                                              [</>] Previous/Next Page
                                        [S] Search  [O] Sort  [R] Reset Filters
                                                  [B] Back to Menu
                                                   Enter choice:
```

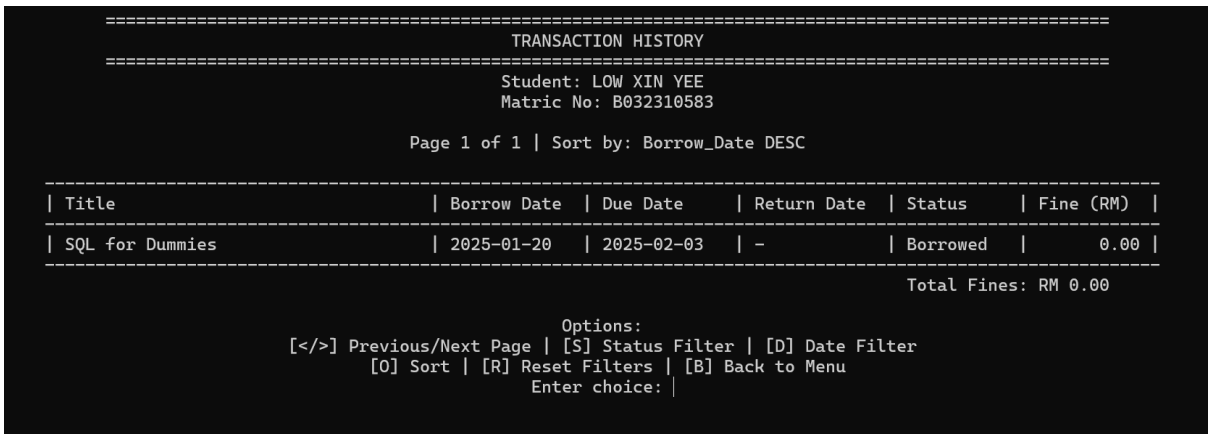
STUDENT MENU – VIEW AVAILABLE BOOK



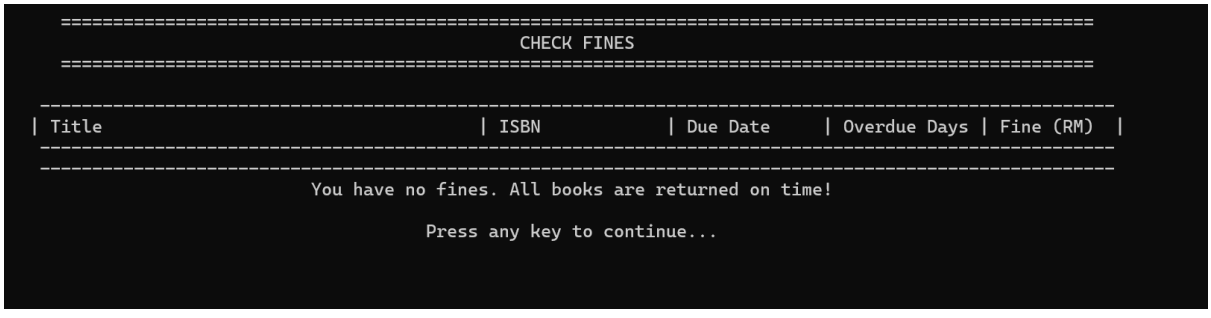
STUDENT MENU – VIEW BORROWED BOOKS



STUDENT MENU – VIEW BORROWING LIMITS



STUDENT MENU – TRANSACTION HISTORY



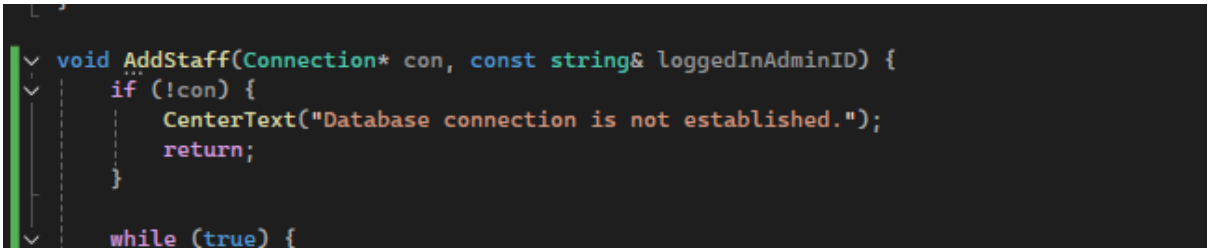
STUDENT MENU – CHECK FINES

CHAPTER 4: IMPLEMENTATION

4.1 Naming Convention

Example of Naming Convention for modules, function, IDs and variables.

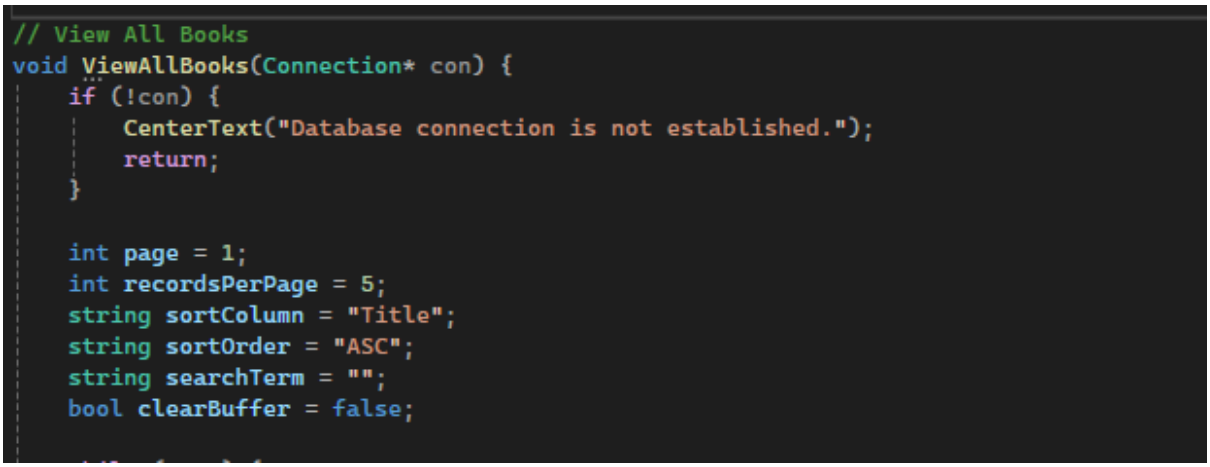
Naming Convention ensure the code to be more readable to the programmer.



```
void AddStaff(Connection* con, const string& loggedInAdminID) {
    if (!con) {
        CenterText("Database connection is not established.");
        return;
    }

    while (true) {
```

Figure 4.1.1



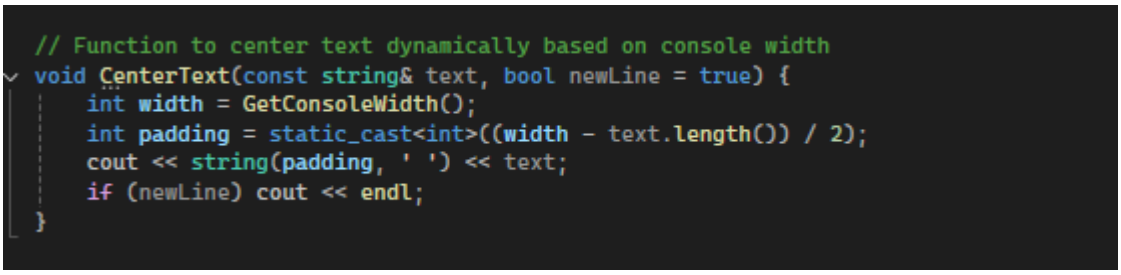
```
// View All Books
void ViewAllBooks(Connection* con) {
    if (!con) {
        CenterText("Database connection is not established.");
        return;
    }

    int page = 1;
    int recordsPerPage = 5;
    string sortColumn = "Title";
    string sortOrder = "ASC";
    string searchTerm = "";
    bool clearBuffer = false;
```

Figure 4.1.2

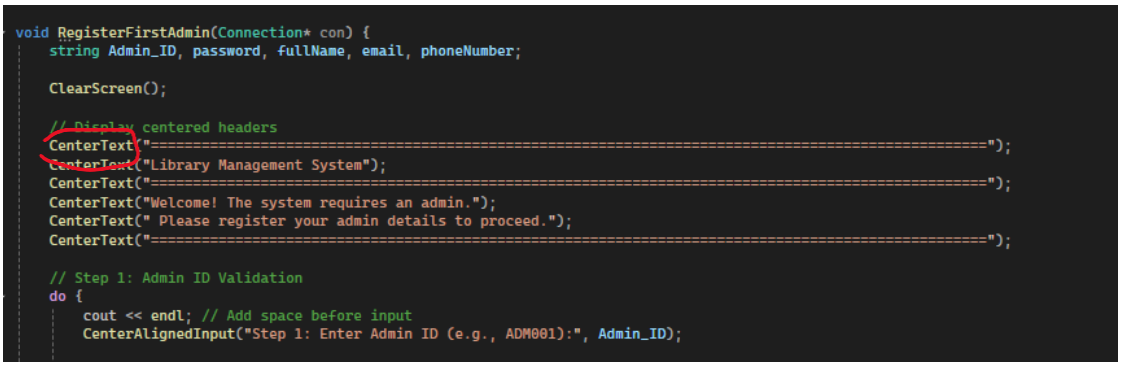
4.2 Function

Function avoid repetition when writing the code, programmer can just do it once and call it back when needed.



```
// Function to center text dynamically based on console width
void CenterText(const string& text, bool newLine = true) {
    int width = GetConsoleWidth();
    int padding = static_cast<int>((width - text.length()) / 2);
    cout << string(padding, ' ') << text;
    if (newLine) cout << endl;
}
```

Figure 4.2.1



```
void RegisterFirstAdmin(Connection* con) {
    string Admin_ID, password, fullName, email, phoneNumber;

    ClearScreen();

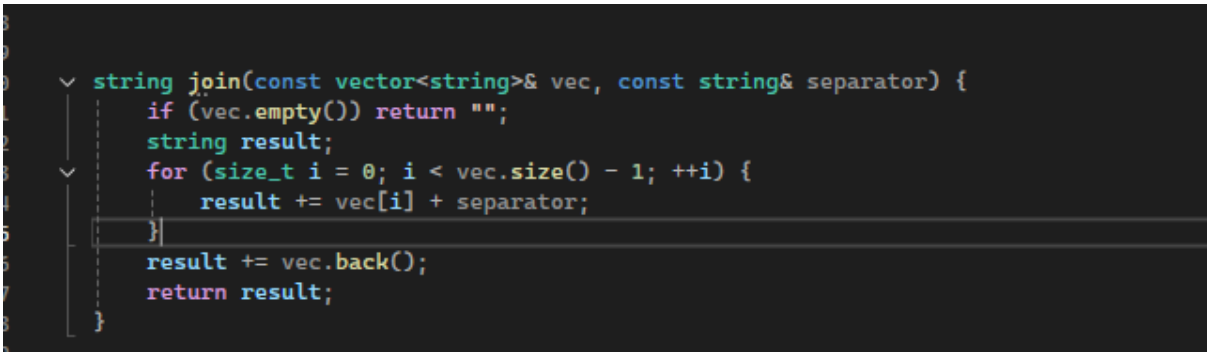
    // Display centered headers
    CenterText("=============================================================================================");
    CenterText("Library Management System");
    CenterText("=============================================================================================");
    CenterText("Welcome! The system requires an admin.");
    CenterText(" Please register your admin details to proceed.");
    CenterText("=============================================================================================");

    // Step 1: Admin ID Validation
    do {
        cout << endl; // Add space before input
        CenterAlignedInput("Step 1: Enter Admin ID (e.g., ADM001):", Admin_ID);
```

Figure 4.2.2

4.3 Array

Array is used to store collection of data such as list of burgers and customers.



```
string join(const vector<string>& vec, const string& separator) {
    if (vec.empty()) return "";
    string result;
    for (size_t i = 0; i < vec.size() - 1; ++i) {
        result += vec[i] + separator;
    }
    result += vec.back();
    return result;
}
```

Figure 4.3.1

4.4 Selection

Selection are used to make decisions based on the conditions.

```
        cin >> choice;

        switch (choice) {
        case 1:
            StaffManagementMenu(con, adminID);
            break;
        case 2:
            BookManagementMenu(con, adminID);
            break;
        case 3:
            ReportsMenu(con);
            break;
        case 4:
            CenterText("Logging out... Thank you, " + adminName + "!");
            this_thread::sleep_for(chrono::seconds(2));
            return;
        default:
            CenterText("Invalid choice. Please try again.");
            this_thread::sleep_for(chrono::seconds(2));
        }
    } while (true);
}
```

Figure 4.4.1

4.5 Control

The code validates user input to ensure correctness and prevent crashes.

```
// Get Quantity
do {
    cout << endl;
    CenterAlignedInput("Enter Quantity (1-10): ", quantity);
    if (cin.fail() || quantity < 1 || quantity > 10) {
        cin.clear();
        cin.ignore(numeric_limits<streamsize>::max(), '\n');
        AlignedErrorMessage("Error: Invalid quantity.", 40);
        continue;
    }
    break;
} while (true);
```

Figure 4.5.1

Pointer

Pointer are used to dynamically allocate the memory and manage database connections.

```
if (toupper(confirm[0]) == 'Y') {
    PreparedStatement* pstmt = con->prepareStatement(
        "INSERT INTO book (Title, ISBN, Floor_No, Author_Name, Quantity, "
        "Classification_Code, Subject_Number, Cutter_Number, PublicationYear, "
        "CollectionSymbol, Call_Number) VALUES (?, ?, ?, ?, ?, ?, ?, ?, ?, ?, ?)"
    );

    pstmt->setString(1, title);
    pstmt->setString(2, isbn);
    pstmt->setInt(3, floorNo);
    pstmt->setString(4, authorName);
    pstmt->setInt(5, quantity);
    pstmt->setString(6, classificationCode);
    pstmt->setString(7, subjectNumber);
    pstmt->setString(8, cutterNumber);
    pstmt->setInt(9, publicationYear);
    pstmt->setString(10, collectionSymbol);
    pstmt->setString(11, callNumber);

    pstmt->executeUpdate();
    delete pstmt;
```

Figure 4.6.1

4.6 Error Handling

Error handling are used to notify the error in the system such as connection to database error or when the user enter a wrong format for anything

```
        }
        catch (SQLException& e) {
            CenterText("Error: Failed to add book.");
            CenterText("SQL Error: " + string(e.what()));
            cout << endl;
            CenterText("Press any key to continue...");
            _getch();
            return;
        }
    }
}
```

Figure 4.7.1

```
CenterText("=============================================================================================================");
CenterText("Library Management System");
CenterText("=============================================================================================================");
CenterText("Welcome! The system requires an admin.");
CenterText(" Please register your admin details to proceed.");
CenterText("=============================================================================================================");

// Step 1: Admin ID Validation
do {
    cout << endl; // Add space before input
    CenterAlignedInput("Step 1: Enter Admin ID (e.g., ADM001):", Admin_ID);

    if (Admin_ID.empty()) {
        AlignedErrorMessage("Error: Admin ID cannot be empty. Please re-enter.", -40);
    }
    else if (!isValidUserID(Admin_ID, "ADM")) {
        // Print the error message directly below
        AlignedErrorMessage("Error: Invalid ID format. Use 'ADM' followed by 3-5 digits (e.g., ADM001).", -40);
    }
```

Figure 4.7.2

CHAPTER 5: CONCLUSION

5.1 Constraints

Library Management System face several constraints that need careful consideration for its successful implementation and ongoing operation. Firstly, Integrating real-time updates across multiple modules (e.g., borrowing, returns, fines) requires meticulous handling of database transactions. Inconsistent synchronization could lead to data discrepancies, such as books appearing available when they are checked out. Secondly, the system must efficiently handle high traffic during peak periods, such as exam seasons or enrollment weeks. Slowdowns or crashes during these times could disrupt borrowing/returning processes, leading to user frustration and operational bottlenecks. Lastly, Regular updates are required to address security flaws and improve features. Limited technical resources might delay critical updates, leaving the system vulnerable to exploits or obsolescence.

5.2 Future Improvements

For future improvements, Library Management System must prioritize Integrating AI-Powered Features, such as personalized book recommendations and demand forecasting, will modernize operations and improve user engagement by aligning resources with borrowing patterns. Secondly, Expanding Mobile Accessibility through a dedicated app will enable members to browse catalogs, renew loans, and pay fines remotely. Features like QR code scanning and push notifications will streamline interactions and enhance convenience. Lastly, Library Management System could implementing Cloud-Based Scalability through elastic resource allocation and optimized database architectures will ensure seamless performance during peak usage, such as exam seasons or enrollment periods, preventing system slowdowns or outages.

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