Green University of Bangladesh

Department of Computer Science and Engineering (CSE)
Semester: (Spring, Year: 2024), B.Sc. in CSE (Day)

Library Management System

Course Title: Database System Lab
Course Code: CSE 210
Section: 221 D17

Students Details

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Submission Date: 21/06/2024
Course Teacher's Name: Farhan Mahmud

[For teachers use only: Don't write anything inside this box]

Lab Project Status	
Marks:	**Signature:**
Comments:	**Date:**

Contents

Chapter 1

Introduction

1.1 Overview

The Library Management System (LMS) is a software system that helps in managing and maintaining the records of a library. It automates various library operations such as book cataloging, member management, borrowing, returning, and tracking of books. This proposal outlines the development of an LMS using MySQL as the database management system.

1.2 Motivation

We chose this project because we see the opportunity to make libraries run smoother with technology, helping staff work better and making it easier for people to find and use books and resources.

1.3 Problem Definition

1.3.1 Problem Statement

The problem we want to solve is that libraries often have outdated systems that make it hard for staff to manage books efficiently and for people to find and use resources easily, so we aim to create a new system that's simple for everyone to use and helps libraries provide better services.

1.4 Design Goals/Objectives

- **Design an efficient database to store library data.**
- **Develop features for easy searching, borrowing, and returning of materials by patrons.**
- **Implement security measures to protect data.**

Table 1.1: Summary of the attributes touched by the mentioned projects

Name of the P Attributess	**Explain how to address**
P1: Depth of knowledge required	The project requires a thorough understanding of database management.Specifically, knowledge in SQL for database creation and management.
P2: Depth of analysis required	Detailed analysis is required to design an efficient database schema that can handle large volumes of data and to ensure that the system's performance is optimized. This includes entity-relationship modeling, normalization processes, and indexing strategies
P3: Familiarity of issues	Familiarity with common issues in library management, such as cataloging errors, data redundancy, and user authentication challenges, is essential.

1.5 Application

The Library Management System (LMS) makes it easier for all kinds of libraries, like schools, public libraries, and businesses, to organize their books and resources well. Librarians can easily keep track of everything, so users can quickly find what they're looking for. People can search for books, reserve them, and use library services online, which makes things more convenient. The LMS also gives librarians helpful information about how the library is used, so they can make better decisions about what to offer. Basically, the LMS helps libraries run smoothly and makes it easier for everyone to use them

Chapter 2

Design/Development/Implementation of the Project

2.1 Introduction

The Library Management System (LMS) project aims to modernize how libraries manage resources and interact with patrons. Using MySQL, this project will create an efficient, user-friendly, and secure system to streamline library operations and improve user experiences.

2.2 Project Details

In this section, we will delve into the specifics of the LMS project, covering various aspects of its development and implementation.

- **Schema Development:** We'll carefully design the database structure to store and manage library data efficiently. This includes creating tables for books, members, borrowing records, and more, making sure to reduce data repetition and boost performance.
- **Entity-Relationship Model:** We'll create a visual diagram to show how different parts of the database, like books, members, and transactions, are connected.

2.3 Tools and libraries

- XAMPP
- MS Word
- Overleaf
- Diagram.io

2.4 Implementation

2.4.1 Schema Diagram

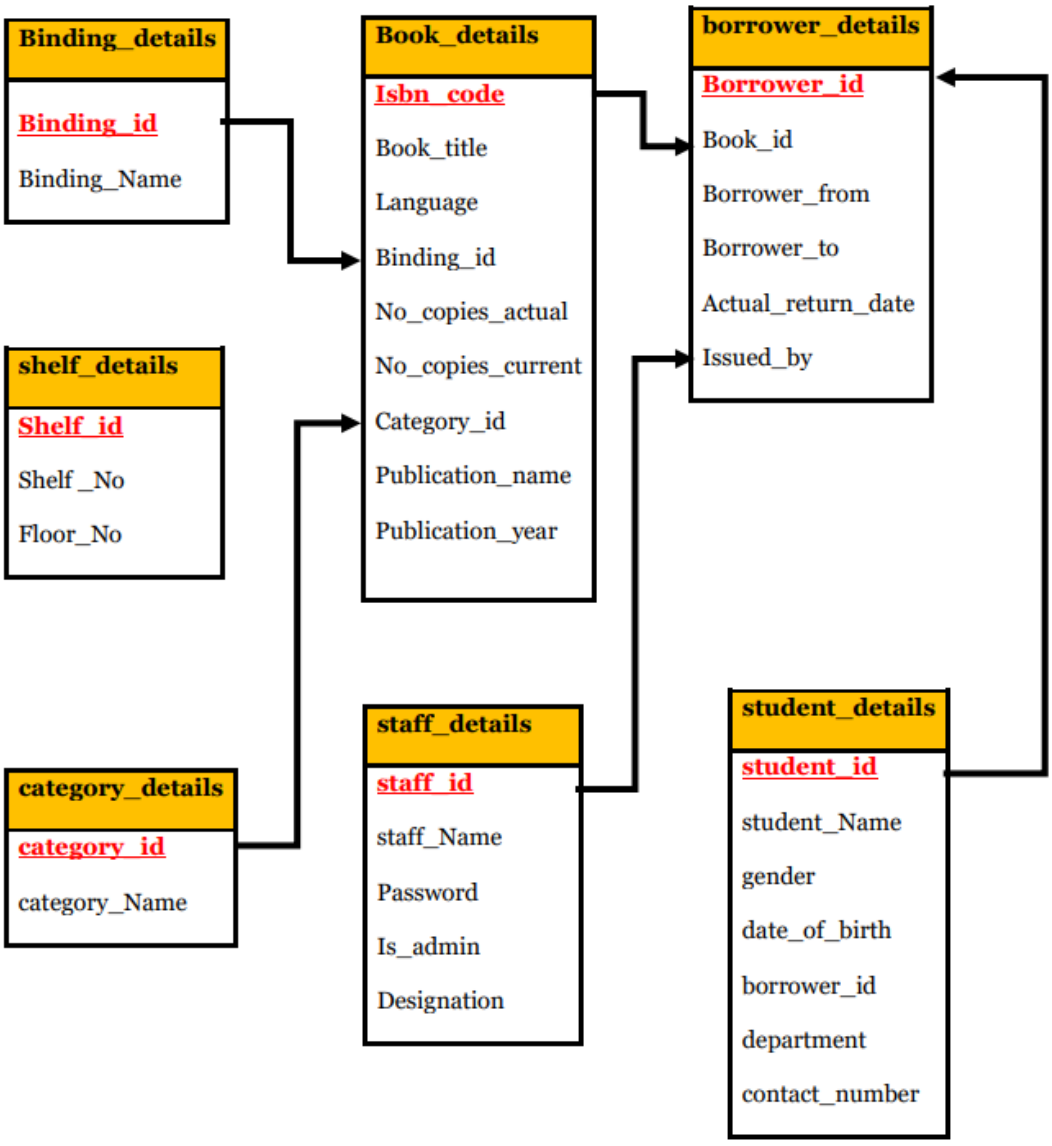


Figure 2.1: **Library Management System Database Schema Diagram.**

2.4.2 ER Diagram

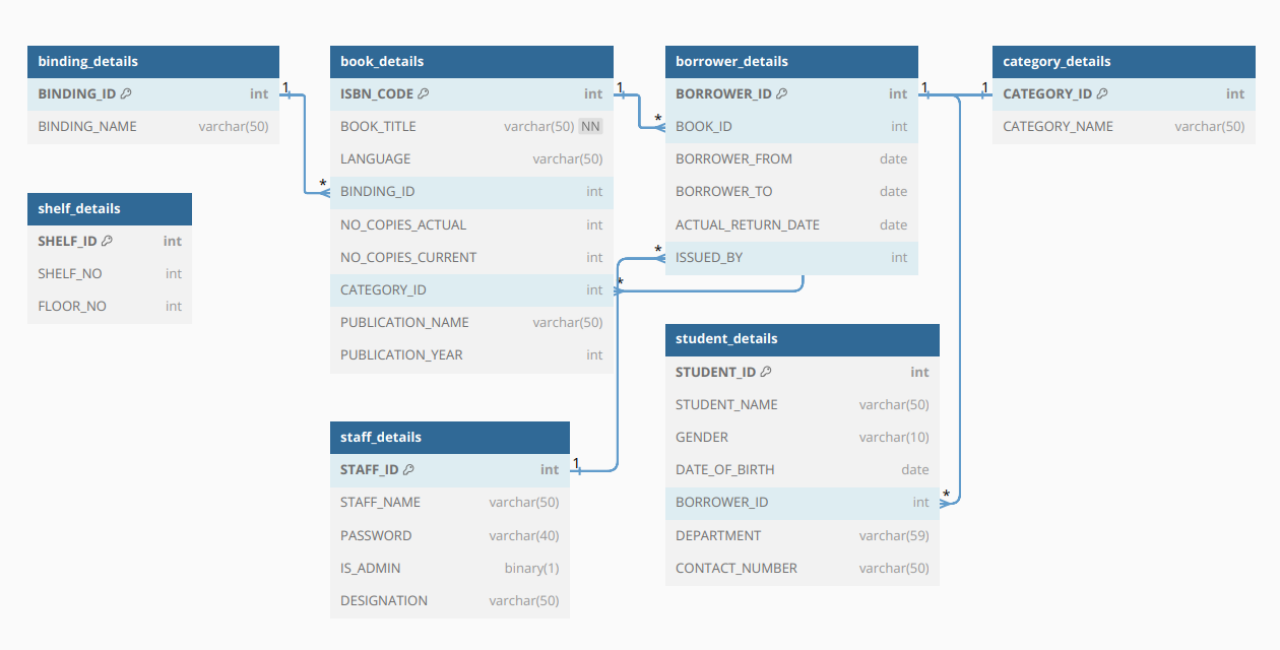


Figure 2.2: Library Management System Database ER Diagram.

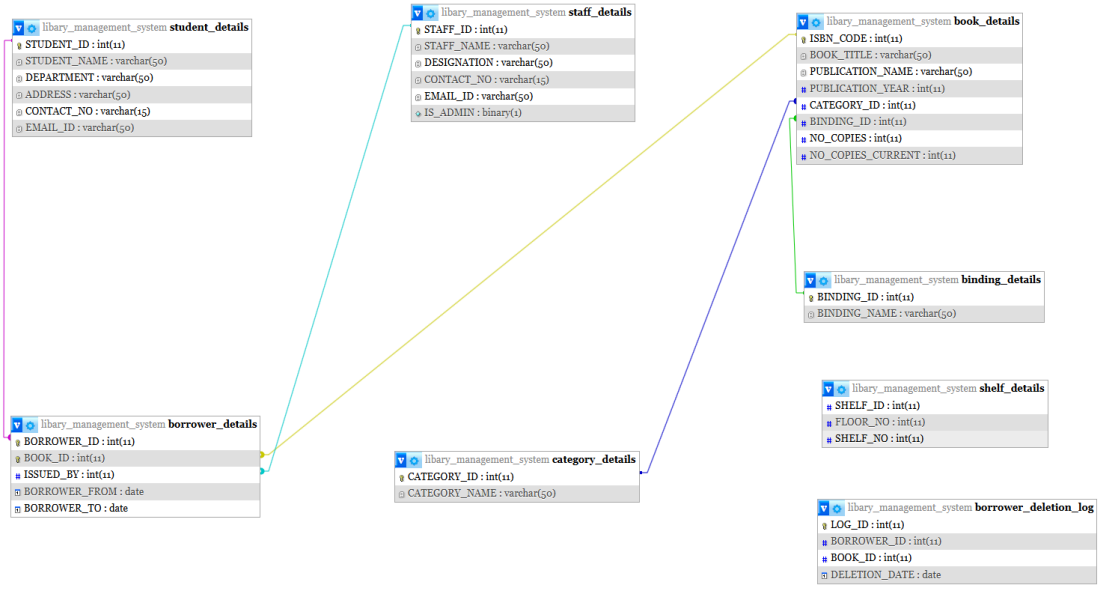


Figure 2.3: XAMPP : Library Management System Database ER Diagram

2.5 Tables

- ```
  CREATE TABLE binding_details (
      BINDING_ID int NOT NULL,
      BINDING_NAME varchar(50)
  );
  ```

- ```
  CREATE TABLE book_details (
      ISBN_CODE int NOT NULL,
      BOOK_TITLE varchar(50),
      PUBLICATION_NAME varchar(50),
      PUBLICATION_YEAR int,
      CATEGORY_ID int,
      BINDING_ID int,
      NO_COPIES int,
      NO_COPIES_CURRENT int
  );
  ```

- ```
  CREATE TABLE borrower_details (
      BORROWER_ID int NOT NULL,
      BOOK_ID int NOT NULL,
      ISSUED_BY int,
      BORROWER_FROM date,
      BORROWER_TO date,
      ACTUAL_RETURN_DATE date
  );
  ```

- ```
  CREATE TABLE category_details (
      CATEGORY_ID int NOT NULL,
      CATEGORY_NAME varchar(50)
  );
  ```

- ```
  CREATE TABLE staff_details (
      STAFF_ID int NOT NULL,
      STAFF_NAME varchar(50),
      DESIGNATION varchar(50),
      CONTACT_NO varchar(15),
      EMAIL_ID varchar(50),
      IS_ADMIN binary
  );
  ```
  ```

```sql
CREATE TABLE student_details (
    STUDENT_ID int NOT NULL,
    STUDENT_NAME varchar(50),
    DEPARTMENT varchar(50),
    ADDRESS varchar(50),
    CONTACT_NO varchar(15),
    EMAIL_ID varchar(50)
);

);
```

```sql
CREATE TABLE shelf_details (
    SHELF_ID int NOT NULL,
    FLOOR_NO int,
    SHELF_NO int
);
```

```sql
ALTER TABLE borrower_details
ADD PRIMARY KEY (BOOK_ID,BORROWER_ID);
```

```sql
ALTER TABLE binding_details
ADD PRIMARY KEY (BINDING_ID);

ALTER TABLE book_details
ADD CONSTRAINT fk_binding
FOREIGN KEY (BINDING_ID) REFERENCES binding_details(BINDING_ID);

);
```

```sql
ALTER TABLE category_details
ADD PRIMARY KEY(CATEGOR_ID);

ALTER TABLE book_details
ADD CONSTRAINT fk_category_id
FOREIGN KEY (CATEGORY_ID) REFERENCES category_details(CATEGORY_ID);
```

```sql
ALTER TABLE book_details
ADD PRIMARY KEY (ISBN_CODE);

ALTER TABLE borrower_details
ADD CONSTRAINT fk_book_id
FOREIGN KEY (BOOK_ID) REFERENCES book_details(ISBN_CODE);
```

```sql
ALTER TABLE staff_details
ADD PRIMARY KEY (STAFF_ID);

ALTER TABLE borrower_details
ADD CONSTRAINT fk_issued_by
FOREIGN KEY (ISSUED_BY) REFERENCES staff_details(STAFF_ID);
```

```sql
ALTER TABLE student_details
ADD PRIMARY KEY (STUDENT_ID);


ALTER TABLE borrower_details
ADD CONSTRAINT fk_borrower_id
FOREIGN KEY (BORROWER_ID) REFERENCES student_details(STUDENT_ID);
```

```sql
INSERT INTO staff_details (STAFF_ID, STAFF_NAME, DESIGNATION, CONTACT_NO,
    EMAIL_ID, IS_ADMIN) VALUES
(441, "Ahmed Rahim", "Librarian", "01721548754", "ahmed@gmail.com",0),
(443, "Mahbub Alam", "Library Technician", "01921548756","mahbub@gmail.com",0),
(444, "Nasrin Akter", "Library Assistant", "01821548757","nasrin@gmail.com",0),
(445, "Jamil Hossain", "Senior Librarian", "01721548758", "jamil@gmail.com",1),
(446, "Tania Parvin", "Cataloger", "01621548759", "tania@gmail.com",0),
(447, "Kamal Uddin", "Archivist", "01721548760", "kamal@gmail.com",0),
(448, "Razia Sultana", "Library Assistant", "01621548761","razia@gmail.com",0),
(449, "Imran Khan", "Reference Librarian", "01621548762", "imran@gmail.com",0),
(450, "Shirin Akhter", "Circulation Clerk","01721548763","shirin@gmail.com",0);
```

```sql
INSERT INTO binding_details (BINDING_ID, BINDING_NAME) VALUES
(1, 'Hardcover'),
(2, 'Paperback'),
(3, 'Spiral Bound'),
(4, 'Leather Bound'),
(5, 'Digital');
```

```sql
INSERT INTO category_details (CATEGORY_ID, CATEGORY_NAME) VALUES
(1, 'Fiction'),
(2, 'Non-Fiction'),
(3, 'Science'),
(4, 'History'),
(5, 'Biography');
```

```sql
INSERT INTO shelf_details (SHELF_ID, FLOOR_NO, SHELF_NO) VALUES
(1, 1, 101),
(2, 1, 102),
(3, 2, 201),
(4, 2, 202),
(5, 3, 301);
```

```sql
INSERT INTO student_details (STUDENT_ID, STUDENT_NAME, DEPARTMENT, ADDRESS,
    CONTACT_NO, EMAIL_ID) VALUES
(221002154, "MONIRUL ISLAM", "CSE", "Pabna","01742958888","monirul@gmail.com"),
(221002155, "FATIMA KHAN", "EEE", "Dhaka","01842958889","fatima@gmail.com"),
(221002156, "RAHIM UDDIN", "CSE","Chittagong","01942958890","rahim@gmail.com"),
(221002157, "SAJIB AHMED", "CE", "Sylhet","01742958891","sajib@gmail.com"),
(221002158, "KAMAL HOSSAIN", "BBA", "Khulna","01842958892","kamal@gmail.com"),
(221002159, "JAMAL UDDIN", "CSE", "Rajshahi","01942958893","jamal@gmail.com"),
(221002160, "KARIM ALI", "EEE", "Barisal","01742958894","karim@gmail.com"),
(221002161, "TANIA AKTER", "ME", "Rangpur","01842958895","tania@gmail.com"),
(221002162, "SAIMA KHAN", "CE", "Dhaka","01942958896","saima@gmail.com"),
(221002163, "RUBEL MIAH", "BBA", "Gazipur","01742958897","rubel@gmail.com"),
(221002165, "AFROZA SULTANA", "EEE", "Dhaka","01942958899","afroza@gmail.com"),
(221002166, "JARINA AKTER", "ME", "Bogura","01742958900","jarina@gmail.com"),
(221002167, "RAFIQ UDDIN","CSE","Cox's Bazar","01842958901","rafiq@gmail.com"),
(221002168, "SHAHIN ALAM", "BBA", "Noakhali","01942958902","shahin@gmail.com"),
(221002170, "RASHIDA KHAN", "EEE", "Pabna","01842958904","rashida@gmail.com"),
(221002171, "SABINA AKTER", "CSE", "Pabna","01942958905","sabina@gmail.com"),
(221002173, "MUSLIM UDDIN", "BBA", "Tangail","01842958907","muslim@gmail.com"),
(221002175, "KHADIJA KHAN", "EEE", "Natore","01742958909","khadija@gmail.com"),
(221002176, "MOTIUR RAHMAN", "ME", "Pabna","01842958910","motiur@gmail.com"),
(221002177, "HANIF UDDIN", "CSE", "Pabna","01942958911","hanif@gmail.com"),
(221002178, "RIZWAN AHMED", "BBA","Dinajpur","01742958912","rizwan@gmail.com"),
(221002179, "MARUF HOSSAIN", "CSE", "Feni","01842958913","maruf@gmail.com"),
(221002180, "MAHIN AKTER", "EEE", "Dhaka","01942958914","mahin@gmail.com"),
(221002182, "TANVIR RAHMAN", "CSE", "Feni","01842958916","tanvir@gmail.com"),
(221002183, "LUBNA AKTER", "BBA", "Pabna","01942958917","lubna@gmail.com");
```

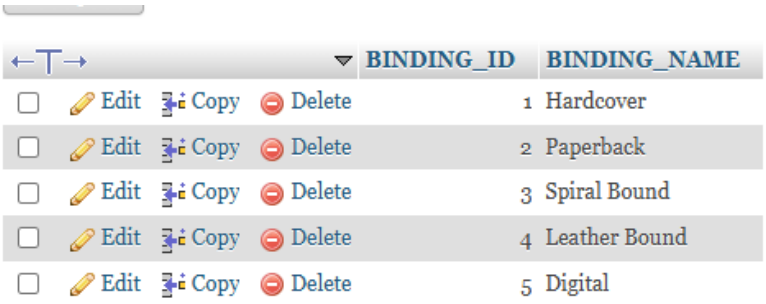
```
INSERT INTO book_details
VALUES
(1001, "Database System Concepts", "McGraw-Hill", 2019, 3, 1, 25, 25),
(1002, "Operating System Concepts", "Wiley", 2020, 3, 2, 20, 20),
(1003, "Fundamentals of Database Systems", "Pearson", 2017, 3, 1, 30, 30),
(1004, "Modern Operating Systems", "Pearson", 2018, 3, 3, 18, 18),
(1005, "Introduction to Algorithms", "MIT Press", 2009, 3, 1, 15, 15),
(1006, "Computer Networks", "Pearson", 2015, 3, 2, 22, 22),
(1007, "Data Structures and Algorithms", "O'Reilly Media", 2016, 3, 1, 28, 28),
(1008, "Database Management Systems", "McGraw-Hill", 2019, 3, 2, 23, 23),
(1009, "UNIX Programming", "Addison-Wesley", 2014, 3, 1, 27, 27),
(1011, 'Moyurakkhi', 'Anannya', 1976, 5, 1, 15, 15),
(1012, 'Dorjar Opashe', 'Anannya', 1981, 5, 2, 18, 18),
(1013, 'Himu', 'Anannya', 1990, 5, 1, 20, 20),
(1014, 'Parapar', 'Anannya', 1983, 5, 2, 22, 22),
(1015, 'Ebong Himu', 'Anannya', 1995, 5, 1, 24, 24),
(1015, 'Physics for Scientists and Engineers', 'Pearson', 2020, 3, 1, 20, 20),
(1016, 'Chemistry: The Central Science', 'Pearson', 2019, 3, 1, 22, 22),
(1017, 'Introduction to Calculus', 'Wiley', 2018, 4, 1, 25, 25),
(1018, 'Fundamentals of Thermodynamics', 'McGraw-Hill', 2017, 3, 2, 18, 18),
(1019, 'Organic Chemistry', 'Wiley', 2017, 3, 2, 24, 24),
(1020, 'Linear Algebra and Its Applications', 'Pearson', 2016, 4, 1, 28, 28),
(1024, 'General Chemistry', 'Wiley', 2018, 3, 1, 26, 26);
```

```
INSERT INTO borrower_details
VALUES
(221002154, 1001, 445, '2024-06-17', '2024-06-24'),
(221002155, 1002, 445, '2024-06-18', '2024-06-25'),
(221002156, 1003, 446, '2024-06-19', '2024-06-26'),
(221002157, 1004, 445, '2024-06-20', '2024-06-27'),
(221002158, 1005, 446, '2024-06-21', '2024-06-28'),
(221002159, 1006, 447, '2024-06-22', '2024-06-29'),
(221002160, 1007, 448, '2024-06-23', '2024-06-30'),
(221002161, 1008, 449, '2024-06-24', '2024-07-01'),
(221002162, 1009, 450, '2024-06-25', '2024-07-02'),
(221002163, 1010, 445, '2024-06-26', '2024-07-03'),
(221002164, 1011, 445, '2024-06-27', '2024-07-04'),
(221002165, 1012, 446, '2024-06-28', '2024-07-05'),
(221002154, 1006, 447, '2024-06-29', '2024-07-06'),
(221002167, 1014, 448, '2024-06-30', '2024-07-07'),
(221002168, 1015, 449, '2024-07-01', '2024-07-08'),
(221002169, 1016, 450, '2024-07-02', '2024-07-09'),
(221002170, 1016, 445, '2024-07-03', '2024-07-10'),
(221002171, 1018, 446, '2024-07-04', '2024-07-11'),
(221002154, 1007, 447, '2024-07-05', '2024-07-12'),
(221002173, 1001, 448, '2024-07-06', '2024-07-13');
```

Chapter 3

Performance Evaluation

3.1 Results Analysis/Testing



	BINDING_ID	BINDING_NAME
Edit Copy Delete	1	Hardcover
Edit Copy Delete	2	Paperback
Edit Copy Delete	3	Spiral Bound
Edit Copy Delete	4	Leather Bound
Edit Copy Delete	5	Digital

Figure 3.1: Binding Details

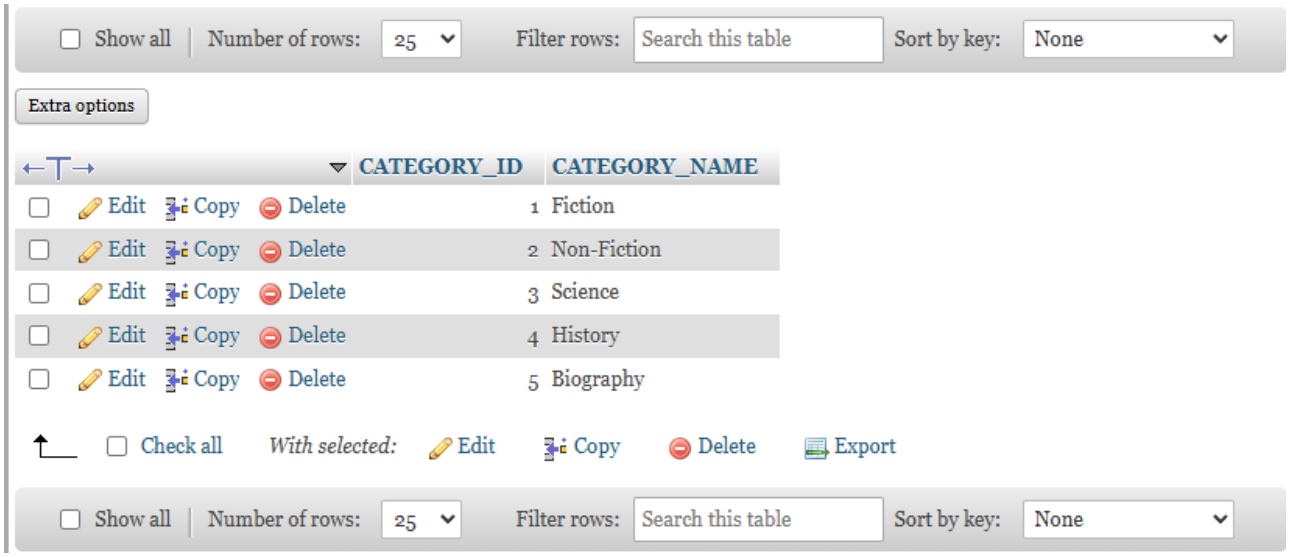


Figure 3.2: Category Details

Show all | Number of rows: 25 Filter rows: Search this table Sort by key: None

Extra options

	STAFF_ID	STAFF_NAME	DESIGNATION	CONTACT_NO	EMAIL_ID	IS_ADMIN
Edit Copy Delete	441	Ahmed Rahim	Librarian	01721548754	ahmed@gmail.com	0
Edit Copy Delete	442	Farhana Islam	Assistant Librarian	01921548755	farhana@gmail.com	0
Edit Copy Delete	443	Mahbub Alam	Library Technician	01921548756	mahbub@gmail.com	0
Edit Copy Delete	444	Nasrin Akter	Library Assistant	01821548757	nasrin@gmail.com	0
Edit Copy Delete	445	Jamil Hossain	Senior Librarian	01721548758	jamil@gmail.com	1
Edit Copy Delete	446	Tania Parvin	Cataloger	01621548759	tania@gmail.com	0
Edit Copy Delete	447	Kamal Uddin	Archivist	01721548760	kamal@gmail.com	0
Edit Copy Delete	448	Razia Sultana	Library Assistant	01621548761	razia@gmail.com	0
Edit Copy Delete	449	Imran Khan	Reference Librarian	01621548762	imran@gmail.com	0
Edit Copy Delete	450	Shirin Akhter	Circulation Clerk	01721548763	shirin@gmail.com	0

Check all *With selected:* Edit Copy Delete Export

Show all | Number of rows: 25 Filter rows: Search this table Sort by key: None

Figure 3.3: Staff Details

	ISBN_CODE	BOOK_TITLE	PUBLICATION_NAME	PUBLICATION_YEAR	CATEGORY_ID	BINDING_ID	NO_COPIES	NO_COPIES_CURRENT
Edit Copy Delete	1001	Database System Concepts	McGraw-Hill	2019	3	1	25	23
Edit Copy Delete	1002	Operating System Concepts	Wiley	2020	3	2	20	19
Edit Copy Delete	1003	Fundamentals of Database Systems	Pearson	2017	3	1	30	28
Edit Copy Delete	1004	Modern Operating Systems	Pearson	2018	3	3	18	17
Edit Copy Delete	1005	Introduction to Algorithms	MIT Press	2009	3	1	15	14
Edit Copy Delete	1006	Computer Networks	Pearson	2015	3	2	22	20
Edit Copy Delete	1007	Data Structures and Algorithms	O'Reilly Media	2016	3	1	28	26
Edit Copy Delete	1008	Database Management Systems	McGraw-Hill	2019	3	2	23	22
Edit Copy Delete	1009	UNIX Programming	Addison-Wesley	2014	3	1	27	26
Edit Copy Delete	1010	Artificial Intelligence: A Modern Approach	Pearson	2021	3	1	24	23
Edit Copy Delete	1011	Moyurakkhi	Anannya	1976	5	1	15	14
Edit Copy Delete	1012	Dorjar Opashe	Anannya	1981	5	2	18	17
Edit Copy Delete	1013	Himu	Anannya	1990	5	1	20	20
Edit Copy Delete	1014	Parapar	Anannya	1983	5	2	22	21
Edit Copy Delete	1015	Ebong Himu	Anannya	1995	5	1	24	23
Edit Copy Delete	1016	Chemistry: The Central Science	Pearson	2019	3	1	22	20
Edit Copy Delete	1017	Introduction to Calculus	Wiley	2018	4	1	25	25
Edit Copy Delete	1018	Fundamentals of Thermodynamics	McGraw-Hill	2017	3	2	18	17
Edit Copy Delete	1019	Organic Chemistry	Wiley	2017	3	2	24	24
Edit Copy Delete	1020	Linear Algebra and Its Applications	Pearson	2016	4	1	28	28
Edit Copy Delete	1021	Introduction to Quantum Mechanics	Cambridge University Press	2020	3	1	20	20
Edit Copy Delete	1022	Statistics for Engineers and Scientists	CRC Press	2019	4	2	22	22
Edit Copy Delete	1023	Discrete Mathematics and Its Applications	McGraw-Hill	2015	4	1	30	30
Edit Copy Delete	1024	General Chemistry	Wiley	2018	3	1	26	26
Edit Copy Delete	1025	Physics for Scientists and Engineers	Pearson	2020	3	1	20	20

Figure 3.4: Book Details

	STUDENT_ID	STUDENT_NAME	DEPARTMENT	ADDRESS	CONTACT_NO	EMAIL_ID
Edit Copy Delete	221002154	MONIRUL ISLAM	CSE	Pabna	01742958888	monirul@gmail.com
Edit Copy Delete	221002155	FATIMA KHAN	EEE	Dhaka	01842958889	fatima@gmail.com
Edit Copy Delete	221002156	RAHIM UDDIN	CSE	Chittagong	01942958890	rahim@gmail.com
Edit Copy Delete	221002157	SAJIB AHMED	CE	Sylhet	01742958891	sajib@gmail.com
Edit Copy Delete	221002158	KAMAL HOSSAIN	BBA	Khulna	01842958892	kamal@gmail.com
Edit Copy Delete	221002159	JAMAL UDDIN	CSE	Rajshahi	01942958893	jamal@gmail.com
Edit Copy Delete	221002160	KARIM ALI	EEE	Barisal	01742958894	karim@gmail.com
Edit Copy Delete	221002161	TANIA AKTER	ME	Rangpur	01842958895	tania@gmail.com
Edit Copy Delete	221002162	SAIMA KHAN	CE	Dhaka	01942958896	saima@gmail.com
Edit Copy Delete	221002163	RUBEL MIAH	BBA	Gazipur	01742958897	rubel@gmail.com
Edit Copy Delete	221002164	HASAN MAHMUD	CSE	Narayanganj	01842958898	hasan@gmail.com
Edit Copy Delete	221002165	AFROZA SULTANA	EEE	Dhaka	01942958899	afroza@gmail.com
Edit Copy Delete	221002166	JARINA AKTER	ME	Bogura	01742958900	jarina@gmail.com
Edit Copy Delete	221002167	RAFIQ UDDIN	CSE	Cox's Bazar	01842958901	rafiq@gmail.com
Edit Copy Delete	221002168	SHAHIN ALAM	BBA	Noakhali	01942958902	shahin@gmail.com
Edit Copy Delete	221002169	ALAMGIR HOSSAIN	CSE	Jessore	01742958903	alamgir@gmail.com
Edit Copy Delete	221002170	RASHIDA KHAN	EEE	Pabna	01842958904	rashida@gmail.com
Edit Copy Delete	221002171	SABINA AKTER	CSE	Pabna	01942958905	sabina@gmail.com
Edit Copy Delete	221002172	SHOHANA SULTANA	CE	Kushtia	01742958906	shohana@gmail.com
Edit Copy Delete	221002173	MUSLIM UDDIN	BBA	Tangail	01842958907	muslim@gmail.com
Edit Copy Delete	221002174	ZAKARIA HOSSAIN	CSE	Sirajganj	01942958908	zakaria@gmail.com
Edit Copy Delete	221002175	KHADIJA KHAN	EEE	Natore	01742958909	khadija@gmail.com
Edit Copy Delete	221002176	MOTIUR RAHMAN	ME	Pabna	01842958910	motiur@gmail.com
Edit Copy Delete	221002177	HANIF UDDIN	CSE	Pabna	01942958911	hanif@gmail.com
Edit Copy Delete	221002178	RIZWAN AHMED	BBA	Dinajpur	01742958912	rizwan@gmail.com

Figure 3.5: Student Details

		BORROWER_ID	BOOK_ID	ISSUED_BY	BORROWER_FROM	BORROWER_TO
☐	Edit Copy Delete	221002154	1001	445	2024-06-17	2024-06-24
☐	Edit Copy Delete	221002173	1001	448	2024-07-06	2024-07-13
☐	Edit Copy Delete	221002155	1002	445	2024-06-18	2024-06-25
☐	Edit Copy Delete	221002154	1003	445	0000-00-00	0000-00-00
☐	Edit Copy Delete	221002156	1003	446	2024-06-19	2024-06-26
☐	Edit Copy Delete	221002157	1004	445	2024-06-20	2024-06-27
☐	Edit Copy Delete	221002154	1005	446	2024-06-17	2024-06-28
☐	Edit Copy Delete	221002154	1006	447	2024-06-29	2024-07-06
☐	Edit Copy Delete	221002159	1006	447	2024-06-22	2024-06-29
☐	Edit Copy Delete	221002154	1007	447	2024-07-05	2024-07-12
☐	Edit Copy Delete	221002160	1007	448	2024-06-23	2024-06-30
☐	Edit Copy Delete	221002161	1008	449	2024-06-24	2024-07-01
☐	Edit Copy Delete	221002162	1009	450	2024-06-25	2024-07-02
☐	Edit Copy Delete	221002154	1010	445	2024-06-26	2024-07-03
☐	Edit Copy Delete	221002164	1011	445	2024-06-27	2024-07-04
☐	Edit Copy Delete	221002165	1012	446	2024-06-28	2024-07-05
☐	Edit Copy Delete	221002167	1014	448	2024-06-30	2024-07-07
☐	Edit Copy Delete	221002168	1015	449	2024-07-01	2024-07-08
☐	Edit Copy Delete	221002169	1016	450	2024-07-02	2024-07-09
☐	Edit Copy Delete	221002170	1016	445	2024-07-03	2024-07-10
☐	Edit Copy Delete	221002171	1018	446	2024-07-04	2024-07-11

Figure 3.6: Borrower Details

3.2 Results Overall Discussion

The system makes tasks like cataloging, managing members, borrowing, and returning books easier. We met our main goals: efficient data storage, and good security. The SQL tables help manage data quickly and easily. Both librarians and users find the system easy to use. We did find some problems like data redundancy, weak security, and slow queries, but we fixed them. Future improvements will focus on better reports, handling more data, and improving the user interface. Overall, the LMS improved library operations and user satisfaction.

Chapter 4

SQL/Trigger/Functions of the Project

4.1 SQL

1. Write a SQL query to find the number of books published by each publication. The results should be sorted in descending order by the number of books.

```sql
SELECT PUBLICATION_NAME, COUNT(BOOK_TITLE) AS NUMBER_OF_BOOK
FROM book_details
GROUP BY PUBLICATION_NAME
ORDER BY NUMBER_OF_BOOK DESC;
```

PUBLICATION_NAME	NUMBER_OF_BOOKS ▾ 1
Pearson	7
Anannya	5
Wiley	4
McGraw-Hill	4
MIT Press	1
CRC Press	1
Cambridge University Press	1
Addison-Wesley	1
O'Reilly Media	1

Figure 4.1: Output Of The SQL Query = 1

2. Count the Total Number of Books in the Entire Dataset

```sql
SELECT COUNT(BOOK_TITLE) AS NUMBER_OF_BOOK
FROM book_details;
```

NUMBER_OF_BOOK
25

Figure 4.2: Output Of The SQL Query = 2

3. Find the oldest and newest publication year for each publication

```
SELECT PUBLICATION_NAME, MIN(PUBLICATION_YEAR) AS OLDEST_YEAR, MAX(PUBLICATION_YEAR)
    AS NEWEST_YEAR
FROM book_details
GROUP BY PUBLICATION_NAME
ORDER BY OLDEST_YEAR ASC;
```

PUBLICATION_NAME	OLDEST_YEAR ▲ 1	NEWEST_YEAR
Anannya	1976	1995
MIT Press	2009	2009
Addison-Wesley	2014	2014
Pearson	2015	2021
McGraw-Hill	2015	2019
O'Reilly Media	2016	2016
Wiley	2017	2020
CRC Press	2019	2019
Cambridge University Press	2020	2020

Figure 4.3: Output Of The SQL Query = 3

4. List the number of books published each year

```
SELECT PUBLICATION_YEAR, COUNT(BOOK_TITLE) AS NUMBER_OF_BOOKS
FROM book_details
GROUP BY PUBLICATION_YEAR
ORDER BY NUMBER_OF_BOOKS DESC;
```

PUBLICATION_YEAR	NUMBER_OF_BOOKS ▼ 1
2019	4
2020	3
2017	3
2018	3
2015	2
2016	2
1976	1
1981	1
1990	1
1983	1
1995	1
2009	1
2014	1
2021	1

Figure 4.4: Output Of The SQL Query = 4

5. Find books that have less than 20 copies currently available

```
SELECT BOOK_TITLE, NO_COPIES_CURRENT
FROM book_details
WHERE NO_COPIES_CURRENT < 20;
```

BOOK_TITLE	NO_COPIES_CURRENT
Operating System Concepts	19
Modern Operating Systems	17
Introduction to Algorithms	14
Moyurakkhi	14
Dorjar Opashe	17
Fundamentals of Thermodynamics	17

Figure 4.5: Output Of The SQL Query = 5

6. Find the number of students in each department.

```
SELECT department, COUNT(student_id) AS Number_of_Students
FROM student_details
GROUP BY department
ORDER BY Number_of_Students DESC;
```

department	Number_of_Students ▾ 1
CSE	11
BBA	6
EEE	6
ME	4
CE	3

Figure 4.6: Output Of The SQL Query = 6

7. Find the number of books issued by each staff member.

```
SELECT s.staff_Name, COUNT(bd.Book_id) AS Books_Issued
FROM staff_details s
JOIN borrower_details bd ON s.staff_id = bd.Issued_by
GROUP BY s.staff_Name;
```

staff_Name	Books_Issued
Imran Khan	2
Jamil Hossain	7
Kamal Uddin	3
Razia Sultana	3
Shirin Akhter	2
Tania Parvin	4

Figure 4.7: Output Of The SQL Query = 7

8. Find the number of books borrowed by each department.

```sql
SELECT sd.department, COUNT(bd.Book_id) AS Number_of_Books_Borrowed
FROM student_details sd
JOIN borrower_details bd ON sd.STUDENT_ID= bd.Borrower_id
GROUP BY sd.department;
```

department	Number_of_Books_Borrowed
BBA	2
CE	2
CSE	12
EEE	4
ME	1

Figure 4.8: Output Of The SQL Query = 8

9. List the number of books available for each binding type.

```sql
SELECT bd.Binding_Name, COUNT(b.Book_title) AS Number_of_Books
FROM book_details b
JOIN binding_details bd ON b.Binding_id = bd.Binding_id
GROUP BY bd.Binding_Name;
```

Binding_Name	Number_of_Books
Hardcover	16
Paperback	8
Spiral Bound	1

Figure 4.9: Output Of The SQL Query = 9

10. Find books that have never been borrowed.

```sql
SELECT b.Book_title
FROM book_details b
LEFT JOIN borrower_details bd ON b.Isbn_code = bd.Book_id
WHERE bd.Book_id IS NULL;
```

Book_title
Himu
Introduction to Calculus
Organic Chemistry
Linear Algebra and Its Applications
Introduction to Quantum Mechanics
Statistics for Engineers and Scientists
Discrete Mathematics and Its Applications
General Chemistry
Physics for Scientists and Engineers

Figure 4.10: Output Of The SQL Query = 10

;

11. Find the total number of books borrowed by each student.

```
SELECT sd.student_Name, COUNT(bd.Book_id) AS Number_of_Books_Borrowed
FROM student_details sd
JOIN borrower_details bd ON sd.STUDENT_ID = bd.Borrower_id
GROUP BY sd.student_Name
ORDER by COUNT(bd.BOOK_ID) DESC
```

student_Name	Number_of_Books_Borrowed
MONIRUL ISLAM	6
JAMAL UDDIN	1
ALAMGIR HOSSAIN	1
SAJIB AHMED	1
SHAHIN ALAM	1
RAHIM UDDIN	1
RAFIQ UDDIN	1
FATIMA KHAN	1
AFROZA SULTANA	1
HASAN MAHMUD	1
SAIMA KHAN	1
MUSLIM UDDIN	1
TANIA AKTER	1
SABINA AKTER	1
KARIM ALI	1
RASHIDA KHAN	1

Figure 4.11: Output Of The SQL Query = 11

12. List the number of books published each year.

```
SELECT Publication_year, COUNT(Book_title) AS Number_of_Books
FROM book_details
GROUP BY Publication_year
ORDER BY Number_of_Books DESC;
```

Publication_year	Number_of_Books ▾ 1
2019	4
2020	3
2017	3
2018	3
2015	2
2016	2
2021	1
1976	1
1981	1
1990	1
1983	1
1995	1
2009	1
2014	1

Figure 4.12: Output Of The SQL Query = 12

13. Write an SQL query to list the Student details who use a Grameenphone SIM card.

```sql
SELECT STUDENT_ID, STUDENT_NAME, CONTACT_NO
FROM student_details
WHERE CONTACT_NO LIKE "017%" OR CONTACT_NO LIKE "013%";
```

STUDENT_ID	STUDENT_NAME	CONTACT_NO
221002154	MONIRUL ISLAM	01742958888
221002157	SAJIB AHMED	01742958891
221002160	KARIM ALI	01742958894
221002163	RUBEL MIAH	01742958897
221002166	JARINA AKTER	01742958900
221002169	ALAMGIR HOSSAIN	01742958903
221002172	SHOHANA SULTANA	01742958906
221002175	KHADIJA KHAN	01742958909
221002178	RIZWAN AHMED	01742958912
221002181	ISRAFIL HOSSAIN	01742958915

Figure 4.13: Output Of The SQL Query = 13

14. List the books that have been borrowed the most

```sql
SELECT bd.BOOK_TITLE, COUNT(br.BOOK_ID) AS TIMES_BORROWED
FROM borrower_details br
JOIN book_details bd ON br.BOOK_ID = bd.ISBN_CODE
GROUP BY bd.BOOK_TITLE
ORDER BY TIMES_BORROWED DESC;
```

BOOK_TITLE	TIMES_BORROWED ▾ 1
Computer Networks	2
Chemistry: The Central Science	2
Fundamentals of Database Systems	2
Database System Concepts	2
Data Structures and Algorithms	2
UNIX Programming	1
Fundamentals of Thermodynamics	1
Introduction to Algorithms	1
Database Management Systems	1
Modern Operating Systems	1
Ebong Himu	1
Operating System Concepts	1
Parapar	1
Artificial Intelligence: A Modern Approach	1
Dorjar Opashe	1
Moyurakkhi	1

Figure 4.14: Output Of The SQL Query = 14

15. List all the books borrowed by students in the CSE department

```sql
SELECT bd.BOOK_TITLE, sd.STUDENT_NAME
FROM borrower_details br
JOIN book_details bd ON br.BOOK_ID = bd.ISBN_CODE
JOIN student_details sd ON br.BORROWER_ID = sd.STUDENT_ID
WHERE sd.DEPARTMENT = "CSE";
```

BOOK_TITLE	STUDENT_NAME
Database System Concepts	MONIRUL ISLAM
Fundamentals of Database Systems	MONIRUL ISLAM
Introduction to Algorithms	MONIRUL ISLAM
Computer Networks	MONIRUL ISLAM
Data Structures and Algorithms	MONIRUL ISLAM
Artificial Intelligence: A Modern Approach	MONIRUL ISLAM
Fundamentals of Database Systems	RAHIM UDDIN
Computer Networks	JAMAL UDDIN
Moyurakkhi	HASAN MAHMUD
Parapar	RAFIQ UDDIN
Chemistry: The Central Science	ALAMGIR HOSSAIN
Fundamentals of Thermodynamics	SABINA AKTER

Figure 4.15: Output Of The SQL Query = 15

16. Find the maximum number of books a single student has borrowed

```sql
SELECT sd.STUDENT_NAME, COUNT(br.BOOK_ID) AS TOTAL_BORROWED
FROM borrower_details br
JOIN student_details sd ON br.BORROWER_ID = sd.STUDENT_ID
GROUP BY sd.STUDENT_NAME
ORDER BY TOTAL_BORROWED DESC
LIMIT 1;
```

STUDENT_NAME	TOTAL_BORROWED
MONIRUL ISLAM	6

Figure 4.16: Output Of The SQL Query = 16

4.2 Trigger

1. To create a trigger that decreases the current number of available copies of a book when a student borrows a book and inserts a record into the borrower_details table.

```
CREATE TRIGGER after_borrow_insert
AFTER INSERT ON borrower_details
FOR EACH ROW
BEGIN
    UPDATE book_details
    SET NO_COPIES_CURRENT = NO_COPIES_CURRENT - 1
    WHERE ISBN_CODE = NEW.BOOK_ID;
END;
```

ISBN_CODE	BOOK_TITLE	PUBLICATION_NAME	PUBLICATION_YEAR	CATEGORY_ID	BINDING_ID	NO_COPIES	NO_COPIES_CURRENT
1001	Database System Concepts	McGraw-Hill	2019	3	1	25	23
1002	Operating System Concepts	Wiley	2020	3	2	20	19
1003	Fundamentals of Database Systems	Pearson	2017	3	1	30	28
1004	Modern Operating Systems	Pearson	2018	3	3	18	17
1005	Introduction to Algorithms	MIT Press	2009	3	1	15	14
1006	Computer Networks	Pearson	2015	3	2	22	20
1007	Data Structures and Algorithms	O'Reilly Media	2016	3	1	28	26
1008	Database Management Systems	McGraw-Hill	2019	3	2	23	22
1009	UNIX Programming	Addison-Wesley	2014	3	1	27	26
1010	Artificial Intelligence: A Modern Approach	Pearson	2021	3	1	24	23
1011	Moyurakkhi	Anannya	1976	5	1	15	14
1012	Dorjar Opashe	Anannya	1981	5	2	18	17
1013	Himu	Anannya	1990	5	1	20	20
1014	Parapar	Anannya	1983	5	2	22	21

Figure 4.17: Output Of The SQL Query = 01

2. Create a trigger named check_borrow_limit that prevents a student from borrowing more than 5 books at a time by raising an error with the message "Cannot borrow more than 5 books at a time".

```
DELIMITER
//
CREATE TRIGGER check_borrow_limit
BEFORE INSERT ON borrower_details
FOR EACH ROW
BEGIN
    DECLARE book_count INT;
    SELECT COUNT(*) INTO book_count
    FROM borrower_details
    WHERE BORROWER_ID = NEW.BORROWER_ID;

    IF book_count >= 5 THEN
        SIGNAL SQLSTATE '45000' SET MESSAGE_TEXT = 'Cannot borrow more than 5 books
            at a time';
    END IF;
END;
//
DELIMITER ;
```

3. Trigger to Track Deletions from Borrower Details.

```
CREATE TABLE borrower_deletion_log (
    LOG_ID INT AUTO_INCREMENT PRIMARY KEY,
    BORROWER_ID INT,
    BOOK_ID INT,
    DELETION_DATE DATE
);

DELIMITER //
CREATE TRIGGER log_borrower_deletion
AFTER DELETE ON borrower_details
FOR EACH ROW
BEGIN
    INSERT INTO borrower_deletion_log (BORROWER_ID, BOOK_ID, DELETION_DATE)
    VALUES (OLD.BORROWER_ID, OLD.BOOK_ID, CURRENT_DATE);
END ;
//
DELIMITER ;
```

LOG_ID	BORROWER_ID	BOOK_ID	DELETION_DATE
1	221002154	1003	2024-06-17
2	221002154	1005	2024-06-17
3	221002159	1006	2024-06-17

Figure 4.18: Output of The Trigger = 03

4. Auto-Set Borrowing Dates

```
DELIMITER //
CREATE TRIGGER set_borrow_dates
BEFORE INSERT ON borrower_details
FOR EACH ROW
BEGIN
    SET NEW.BORROWER_FROM = CURDATE();
    SET NEW.BORROWER_TO = DATE_ADD(CURDATE(), INTERVAL 7 DAY);
END
//
DELIMITER ;
```

4.3 Functions

1. Create a function named available_book that takes a book_id as input and returns the number of available copies for that book.

```
DELIMITER //
CREATE FUNCTION available_book(book_id INT) RETURNS INT
BEGIN
    DECLARE available_copies INT;
    SELECT NO_COPIES_CURRENT INTO available_copies
    FROM book_details
    WHERE ISBN_CODE = book_id;
    RETURN available_copies;
END;
//
DELIMITER ;
```

```
SELECT ISBN_CODE, BOOK_TITLE ,available_book(ISBN_CODE) AS available_copies
FROM book_details;
```

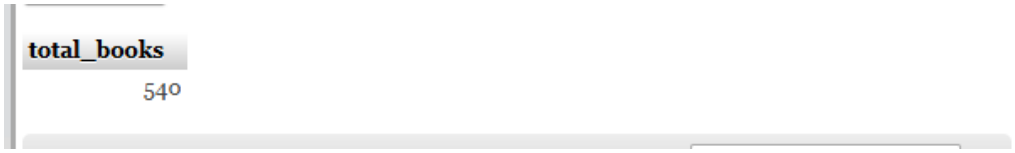
	ISBN_CODE	BOOK_TITLE	available_copies
te	1001	Database System Concepts	23
te	1002	Operating System Concepts	19
te	1003	Fundamentals of Database Systems	24
te	1004	Modern Operating Systems	17
te	1005	Introduction to Algorithms	14
te	1006	Computer Networks	20
te	1007	Data Structures and Algorithms	25
te	1008	Database Management Systems	22
te	1009	UNIX Programming	26
te	1010	Artificial Intelligence: A Modern Approach	23
te	1011	Moyurakkhi	14
te	1012	Dorjar Opashe	17
te	1013	Himu	20
te	1014	Parapar	21
te	1015	Ebong Himu	23
te	1016	Chemistry: The Central Science	20
te	1017	Introduction to Calculus	25
te	1018	Fundamentals of Thermodynamics	17
te	1019	Organic Chemistry	24
te	1020	Linear Algebra and Its Applications	28
te	1021	Introduction to Quantum Mechanics	20
te	1022	Statistics for Engineers and Scientists	22
te	1023	Discrete Mathematics and Its Applications	30
te	1024	General Chemistry	26
te	1025	Physics for Scientists and Engineers	20

Figure 4.19: Output of The Function = 01

2. Write a SQL function to calculate the total number of books available in the book_details

```
DELIMITER //
CREATE FUNCTION get_total_books() RETURNS INT
BEGIN
    DECLARE total_books INT;
    SELECT SUM(NO_COPIES) INTO total_books
    FROM book_details;
    RETURN total_books;
END //
DELIMITER ;
```

```
SELECT get_total_books() AS total_books;
```



total_books
540

Figure 4.20: Output of The Function = 02

3. Write a SQL function to retrieve the name of a borrower from the student_details

```
DELIMITER //
BEGIN
    DECLARE borrower_name VARCHAR(100);
    SELECT STUDENT_NAME INTO borrower_name
    FROM student_details
    WHERE STUDENT_ID = borrower_id;
    RETURN borrower_name
END //
DELIMITER ;
```

```
SELECT get_borrower_name(221002154) AS borrower_name;
```

borrower_name
MONIRUL ISLAM

Figure 4.21: Output of The Function = 03

Chapter 5

Conclusion

5.1 Discussion

This chapter explains the results of the Library Management System (LMS) project. The system was designed to simplify tasks like cataloging, managing members, borrowing, and returning books. We achieved our main goals: efficient data storage, user-friendly features, and good security. The SQL tables helped manage data quickly and effectively. Both librarians and users found the system easy to use. Some issues, like data redundancy, weak initial security, and slow queries, were found but resolved. Future improvements will focus on better reports, handling more data, and enhancing the user interface. Overall, the LMS improved library operations and user satisfaction

5.2 Limitations

The project has some limitations. The initial setup had issues with data redundancy, requiring normalization. The initial security measures were weak, posing risks until they were strengthened. Some SQL queries were slow due to a lack of proper indexing, affecting performance until optimized. The system may also struggle with scalability as the library grows, potentially needing further enhancements to handle more data and users.

5.3 Scope of Future Work

Future work on the LMS project will include developing advanced reporting features for better insights into library usage. Efforts will focus on ensuring the system can scale to handle more data and users efficiently. Continuous improvements to the user interface will be made based on user feedback to enhance usability. Additionally, exploring integration with other library systems and technologies will be considered to expand the system's capabilities.