

IFSC 3330

LIBRARY MANAGEMENT SYSTEM

(LMS)

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INTRODUCTION:

The Library Management System (LMS) project, designed for IFSC 3330: Current Trends in Database Technology, is a significant advancement in digitizing and enhancing library operations. The project leverages advanced database technology to streamline processes, aiming to boost operational efficiency and user satisfaction. This system is set to enhance library resource management and service delivery, improving accessibility and engagement for both staff and patrons.

In the first phase, the development centered on creating an Entity-Relationship (ER) diagram, outlining key entities such as Staff, Readers, Books, and Publishers, and their interactions like Reserves and Returns. This stage was crucial for setting up a robust database design for efficient data management.

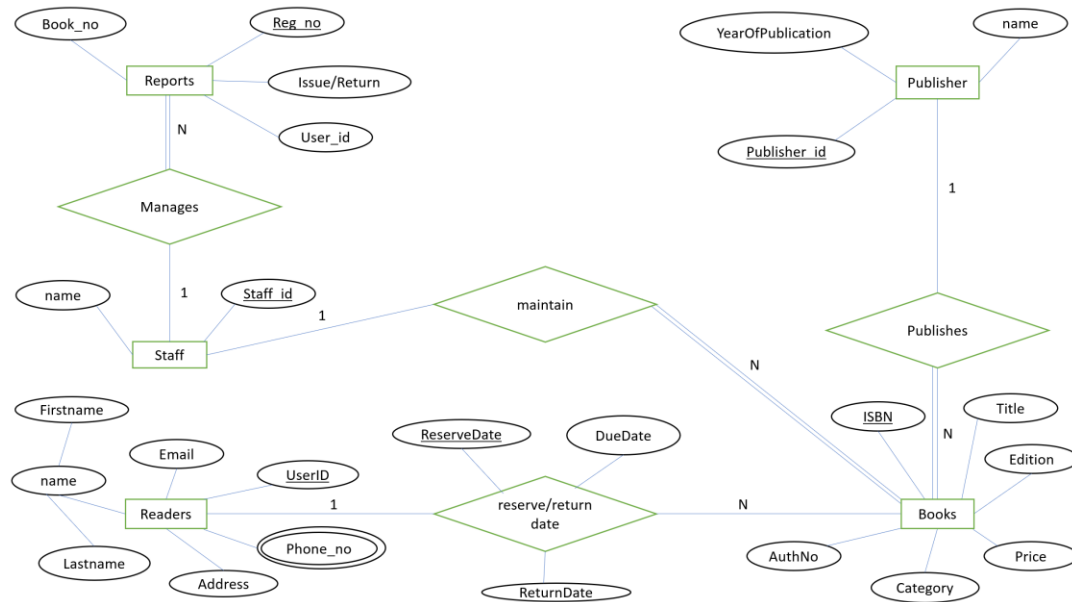
The second phase addressed the normalization of the database schema, transitioning from the First Normal Form (1NF) to overcome issues like partial and transitive dependencies. The database was organized into distinct relations—Reports, Staff, Books, Reserve/Return, Readers, and Publisher—to manage different aspects of library operations effectively.

The third phase involved setting up the actual database using SQL to build tables and manage data interactions through insertions and updates. This setup included establishing foreign key constraints for data integrity and populating tables with initial data, thus preparing the system for real-world use.

Finally, the last phase focused on deploying SQL queries for data retrieval and manipulation according to user needs, including generating reports and handling book transactions. The introduction of triggers and stored procedures automated routine tasks, ensuring the system remained current and responsive to library needs.

PROJECT PHASE 1:

ER Diagram:



Entities and Attributes:

1. Staff:

- Staff_id (Primary Key)
- Name

2. Readers:

- User_ID (Primary Key)
- Firstname
- LastName
- Email
- Phone_no (MVA)
- Address

3. Books:

- ISBN (Primary Key)
- AuthNo
- Title
- Edition
- Category
- Price

4. Publisher:

- Publisher_id (Primary Key)
- Name
- YearOfPublication

5. Reserve/Return (Relationship Set):

- ReserveDate (Primary Key)
- return_date
- Due date

6. Reports:

- Reg_no (Primary Key)
- Book_No
- User_id
- Issue/return date

Relationships:

1. Reader-Book: A reader can reserve N books, but one book can be reserved by only one reader. The relationship 1:N.
2. Publisher-Book: A publisher can publish many books, but a book is published by only one publisher. The relationship 1:N.
3. Staff-Reports: Staff maintains multiple reports. The relationship 1:N.
4. Staff-Books: Staffs maintain multiple books. The relationship 1:N.

Assumptions:

1. Each Staff member has a unique Staff_id.
2. Each Reader has a unique User_ID.
3. Each Book has a unique ISBN.
4. Each Publisher has a unique Publisher_id.
5. Each Report has a unique Reg_no.

Participation Constraints:

- In the Reader-Book relationship, every Book must be reserved by at least one Reader (total participation of Book in the relationship).
- In the Publisher-Book relationship, every Book must be published by exactly one Publisher (total participation of Publisher in the relationship).
- In the Staff-Reports relationship, every Report must be maintained by at least one Staff (total participation of Staff in the relationship).
- In the Staff-Books relationship, every Book must be maintained by at least one Staff (total participation of Staff in the relationship).

Design Goals:

- Ensure efficient management of staff, readers, books, publishers, and reports within the system.
- Allow readers to reserve multiple books while ensuring each book is reserved by only one reader at a time.
- Enable publishers to manage their published books effectively.
- Facilitate staff members in maintaining and generating reports related to book transactions and reader interactions.

PROJECT PHASE 2:

LibraryManagementSystem (Reg_no, Book_no, Issue/Return, User_id, Staff_id, Staff_name, ISBN, Title, Edition, Price, Category, AuthNo, ReserveDate, ReturnDate, DueDate, UserID, Firstname, Lastname, Email, Address, Phone_no, Publisher_id, Publisher_name, YearOfPublication)

FD1: Reg_no --> Book_no, Issue/Return, User_id, Staff_id

FD2: Staff_id --> Staff_name

FD3: ISBN --> Title, Edition, Price, Category, AuthNo, Publisher_id, Staff_id

FD4: ReserveDate --> ReturnDate, DueDate, UserID, ISBN

FD5: UserID --> Firstname, Lastname, Email, Address, Phone_no

FD6: Publisher_id --> Publisher_name, YearOfPublication

Primary Attributes: Reg_no, Staff_id, ISBN, UserID, Publisher_id, ReserveDate

Non-primary Attributes: Book_no, Issue/Return, User_id, Staff_name, Title, Edition, Price, Category, AuthNo, ReturnDate, DueDate, Firstname, Lastname, Email, Address, Phone_no, Publisher_name, YearOfPublication

Partial FDs (if any): FD1, FD4

Transitive FDs (if any): FD2, FD3, FD5, FD6

Full FDs (if any): None

LibraryManagementSystem is only in **1NF** because all attributes are atomic, meaning each attribute value must be indivisible.

LibraryManagementSystem is not in **2NF** or **3NF** due to the presence of partial and transitive dependencies.

Step 1:

- **FD1:** Reg_no --> Book_no, Issue/Return, User_id, Staff_id
(partial)
- **FD2:** Staff_id --> Staff_name (transitive)
- **FD3:** ISBN --> Title, Edition, Price, Category, AuthNo, Publisher_id, Staff_id (transitive)
- **FD4:** ReserveDate --> ReturnDate, DueDate, UserID, ISBN
(partial)
- **FD5:** UserID --> Firstname, Lastname, Email, Address, Phone_no
(transitive)
- **FD6:** Publisher_id --> Publisher_name, YearOfPublication (transitive)

Decomposed Relations:

Reports (Reg_no, Book_no, Issue/Return, User_id, Staff_id)

Staff (Staff_id, Staff_name)

Books (ISBN, Title, Edition, Price, Category, AuthNo, Publisher_id, Staff_id)

Reserve/Return (ReserveDate, DueDate, ReturnDate, UserID, ISBN)

Readers (UserID, Firstname, Lastname, Email, Address, Phone_no)

Publisher (Publisher_id, Publisher_name, YearOfPublication)

Step2: (creating a schema that has the primary key of LMS and attributes that are fully dependent on it (if any).)

There are no full FDs. So, this step is skipped.

Final Results:

Reports (Reg_no, Book_no, Issue/Return, User_id, Staff_id)

Staff (Staff_id, Staff_name)

Books (ISBN, Title, Edition, Price, Category, AuthNo, Publisher_id, Staff_id)

Reserve/Return (ReserveDate, DueDate, ReturnDate, UserID, ISBN)

Readers (UserID, Firstname, Lastname, Email, Address, Phone_no)

Publisher (Publisher_id, Publisher_name, YearOfPublication)

Foreign Key Notations:

- Reports.Staff_id --> Staff.Staff_id
- Books.Staff_id --> Staff.Staff_id
- Books.Publisher_id --> Publisher.Publisher_id
- Reserve/Return.ISBN --> Books.ISBN
- Reserve/Return.UserID --> Readers.UserID

PROJECT PHASE 3:

-- Reports table

DROP TABLE Reports CASCADE CONSTRAINTS;

CREATE TABLE Reports (

Reg_no INT PRIMARY KEY,

Book_no VARCHAR(20),

IssueReturn VARCHAR(10),

User_id INT,

Staff_id INT,

FOREIGN KEY (Staff_id) REFERENCES Staff(Staff_id)

);

INSERT INTO Reports (Reg_no, Book_no, IssueReturn, User_id, Staff_id) VALUES
(001, 'ISBN123456', 'Issue', 101, 1);

INSERT INTO Reports (Reg_no, Book_no, IssueReturn, User_id, Staff_id) VALUES
(002, 'ISBN234567', 'Return', 102, 2);

INSERT INTO Reports (Reg_no, Book_no, IssueReturn, User_id, Staff_id) VALUES
(003, 'ISBN345678', 'Issue', 103, 3);

-- Staff table

DROP TABLE Staff CASCADE CONSTRAINTS;

CREATE TABLE Staff (

Staff_id INT **PRIMARY KEY,**

Staff_name VARCHAR(50)

);

INSERT INTO Staff (Staff_id, Staff_name) **VALUES** (1, 'John Doe');

INSERT INTO Staff (Staff_id, Staff_name) **VALUES** (2, 'Jane Smith');

INSERT INTO Staff (Staff_id, Staff_name) **VALUES** (3, 'Michael Johnson')

-- Books table

DROP TABLE Books CASCADE CONSTRAINTS;

CREATE TABLE Books (

ISBN VARCHAR(20) **PRIMARY KEY**,

VARCCHAR(100),

Edition VARCHAR(50),

Price DECIMAL(10,2),

Category VARCHAR(50),

AuthNo INT,

Publisher_id INT,

Staff_id INT,

FOREIGN KEY (Staff_id) **REFERENCES** Staff(Staff_id),

FOREIGN KEY (Publisher_id) **REFERENCES** Publisher(Publisher_id)

);

INSERT INTO Books (ISBN, Title, Edition, Price, Category, AuthNo, Publisher_id, Staff_id) **VALUES** ('ISBN123456', 'Introduction to SQL', '2nd Edition', 45.99, 'Database', 1234, 1, 1);

INSERT INTO Books (ISBN, Title, Edition, Price, Category, AuthNo, Publisher_id, Staff_id) **VALUES** ('ISBN234567', 'Python Programming', '3rd Edition', 39.99, 'Programming', 2345, 2, 2);

INSERT INTO Books (ISBN, Title, Edition, Price, Category, AuthNo, Publisher_id, Staff_id) **VALUES** ('ISBN345678', 'Data Structures and Algorithms', '4th Edition', 55.99, 'Computer Science', 3456, 3, 3);

-- *Reserve/Return table*

DROP TABLE ReserveReturn CASCADE CONSTRAINTS;

CREATE TABLE ReserveReturn (

ReserveDate DATE **PRIMARY KEY**,

DueDate DATE,

ReturnDate DATE,

UserID INT,

ISBN VARCHAR(20),

FOREIGN KEY (UserID) **REFERENCES** Readers(UserID),

FOREIGN KEY (ISBN) **REFERENCES** Books(ISBN)

);

```
INSERT INTO ReserveReturn (ReserveDate, DueDate, ReturnDate, UserID,  
ISBN) VALUES (TO_DATE('2024-03-01', 'YYYY-MM-DD'), TO_DATE('2024-  
03-15', 'YYYY-MM-DD'), NULL, 101, 'ISBN123456');
```

```
INSERT INTO ReserveReturn (ReserveDate, DueDate, ReturnDate, UserID,  
ISBN) VALUES (TO_DATE('2024-03-05', 'YYYY-MM-DD'), TO_DATE('2024-  
03-20', 'YYYY-MM-DD'), NULL, 102, 'ISBN234567');
```

```
INSERT INTO ReserveReturn (ReserveDate, DueDate, ReturnDate, UserID,  
ISBN) VALUES (TO_DATE('2024-03-10', 'YYYY-MM-DD'), TO_DATE('2024-  
03-25', 'YYYY-MM-DD'), NULL, 103, 'ISBN345678');
```

-- Readers table

```
DROP TABLE Readers CASCADE CONSTRAINTS;
```

```
CREATE TABLE Readers (  
    UserID INT PRIMARY KEY,  
    Firstname VARCHAR(50),  
    Lastname VARCHAR(50),  
    Email VARCHAR(100),  
    Address VARCHAR(200),  
    Phone_no VARCHAR(15)  
);
```

```
INSERT INTO Readers (UserID, Firstname, Lastname, Email, Address, Phone_no)  
VALUES  
(101, 'Alice', 'Johnson', 'alice@example.com', '123 Main St, City', '123-456-7890');
```

```
INSERT INTO Readers (UserID, Firstname, Lastname, Email, Address, Phone_no)  
VALUES  
(102, 'Bob', 'Smith', 'bob@example.com', '456 Elm St, Town', '456-789-0123');
```

```
INSERT INTO Readers (UserID, Firstname, Lastname, Email, Address, Phone_no)
VALUES
(103, 'Charlie', 'Brown', 'charlie@example.com', '789 Oak St, Village', '789-012-3456');
```

-- Publisher table

```
DROP TABLE Publisher CASCADE CONSTRAINTS;
```

```
CREATE TABLE Publisher (
    Publisher_id INT PRIMARY KEY,
    Publisher_name VARCHAR(100),
    YearOfPublication INT
);
```

```
INSERT INTO Publisher (Publisher_id, Publisher_name, YearOfPublication)
VALUES (1, 'Penguin Books', 2005);
```

```
INSERT INTO Publisher (Publisher_id, Publisher_name, YearOfPublication)
VALUES (2, 'HarperCollins', 2010);
```

```
INSERT INTO Publisher (Publisher_id, Publisher_name, YearOfPublication)
VALUES (3, 'Random House', 2015);
```

PROJECT PHASE 4:

Queries:

1. List All Books Issued by a Specific User:

```
SELECT b.Title, b.Edition, rr.ReserveDate, rr.DueDate
```

```
FROM Books b
```

```
JOIN ReserveReturn rr ON b.ISBN = rr.ISBN
```

```
WHERE rr.UserID = 101
```

The screenshot shows the Oracle APEX SQL Workshop interface. The top navigation bar includes 'APEX', 'App Builder', 'SQL Workshop', 'Team Development', and 'Gallery'. A search bar and user profile 'Parikshya Bhandari' are also visible. The 'SQL Commands' tab is active, displaying the following SQL query:

```
1 SELECT b.Title, b.Edition, rr.ReserveDate, rr.DueDate
2 FROM Books b
3 JOIN ReserveReturn rr ON b.ISBN = rr.ISBN
4 WHERE rr.UserID = 101
```

Below the query editor, the 'Results' tab is selected, showing a table with the following data:

TITLE	EDITION	RESERVEDATE	DUEDATE
Introduction to SQL	2nd Edition	03/01/2024	03/15/2024

At the bottom of the results section, it states '1 rows returned in 0.05 seconds' and provides a 'Download' link. The footer of the interface includes the user email 'pbhandari1@ualr.edu', the workspace name 'parikshya098', and the Oracle APEX version '23.2.4'.

2. Find Overdue Books:

```
SELECT rr.ISBN, b.Title, rr.DueDate
```

```
FROM ReserveReturn rr
```

```
JOIN Books b ON rr.ISBN = b.ISBN
```

```
WHERE rr.ReturnDate IS NULL AND rr.DueDate < SYSDATE;
```

APEX App Builder SQL Workshop Team Development Gallery

Search

Schema: WKSP_PARIKSHYA098

Language: SQL Rows: 10 Clear Command Find Tables Save Run

```

1 SELECT rr.ISBN, b.Title, rr.DueDate
2 FROM ReserveReturn rr
3 JOIN Books b ON rr.ISBN = b.ISBN
4 WHERE rr.ReturnDate IS NULL AND rr.DueDate < SYSDATE;
5

```

Results Explain Describe Saved SQL History

ISBN	TITLE	DUEDATE
ISBN123456	Introduction to SQL	03/15/2024
ISBN234567	Python Programming	03/20/2024
ISBN345678	Data Structures and Algorithms	03/25/2024

3 rows returned in 0.06 seconds Download

pbhandari@ualr.edu parikshya098 en Copyright © 1999, 2023, Oracle and/or its affiliates. Oracle APEX 23.2.4

3. List Books Handled by a Specific Staff Member:

SELECT b.ISBN, b.Title, s.Staff_name

FROM Books b

JOIN Staff s ON b.Staff_id = s.Staff_id

WHERE s.Staff_id = 1;

APEX App Builder SQL Workshop Team Development Gallery

Search

Schema: WKSP_PARIKSHYA098

Language: SQL Rows: 10 Clear Command Find Tables Save Run

```

1 SELECT b.ISBN, b.Title, s.Staff_name
2 FROM Books b
3 JOIN Staff s ON b.Staff_id = s.Staff_id
4 WHERE s.Staff_id = 1;
5

```

Results Explain Describe Saved SQL History

ISBN	TITLE	STAFF_NAME
ISBN123456	Introduction to SQL	John Doe

1 rows returned in 0.05 seconds Download

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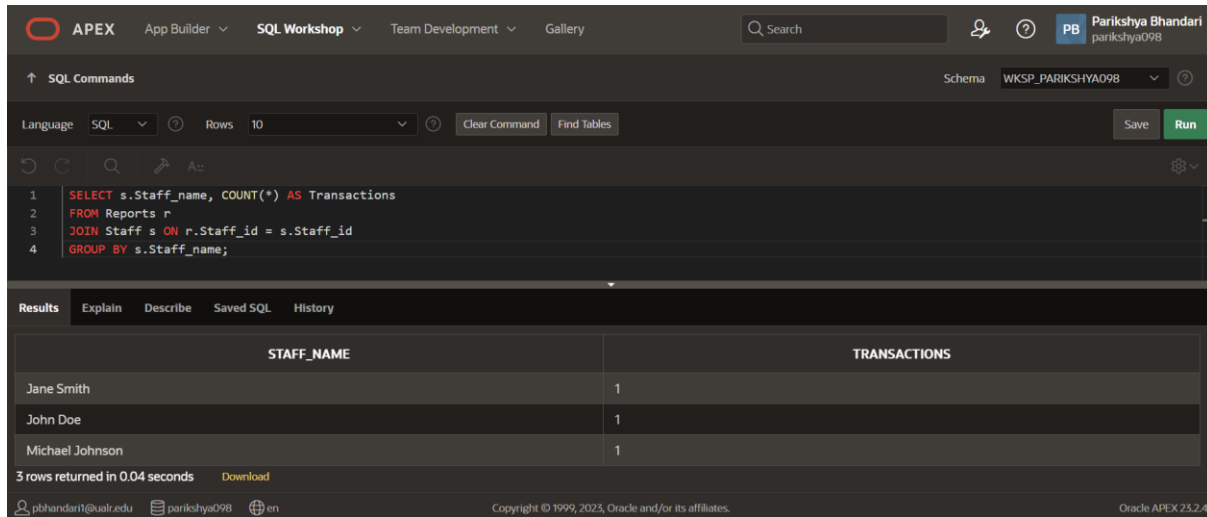
4. Count of Books Issued and Returned by Each Staff Member:

SELECT s.Staff_name, COUNT(*) AS Transactions

FROM Reports r

JOIN Staff s ON r.Staff_id = s.Staff_id

GROUP BY s.Staff_name;



The screenshot shows the Oracle APEX SQL Workshop interface. The top navigation bar includes 'APEX', 'App Builder', 'SQL Workshop', 'Team Development', and 'Gallery'. A search bar and user profile 'Parikshya Bhandari' are also visible. The 'SQL Commands' tab is active, showing a query in the editor:

```
1 SELECT s.Staff_name, COUNT(*) AS Transactions
2 FROM Reports r
3 JOIN Staff s ON r.Staff_id = s.Staff_id
4 GROUP BY s.Staff_name;
```

Below the editor, the 'Results' tab is selected, displaying a table with two columns: 'STAFF_NAME' and 'TRANSACTIONS'. The table contains three rows of data:

STAFF_NAME	TRANSACTIONS
Jane Smith	1
John Doe	1
Michael Johnson	1

At the bottom of the results section, it states '3 rows returned in 0.04 seconds' and provides a 'Download' link. The footer includes the user's email 'pbhandari1@ualr.edu', the workspace name 'parikshya098', and the Oracle APEX version '23.2.4'.

5. Detailed User Information Including Books They Reserved:

SELECT u.Firstname, u.Lastname, u.Email, b.Title

FROM Readers u

JOIN ReserveReturn rr ON u.UserID = rr.UserID

JOIN Books b ON rr.ISBN = b.ISBN;

APEX App Builder SQL Workshop Team Development Gallery Search PB Parikshya Bhandari parikshya098

SQL Commands Schema WKSP_PARIKSHYA098

Language SQL Rows 10 Clear Command Find Tables Save Run

```

1 SELECT u.Firstname, u.Lastname, u.Email, b.Title
2 FROM Readers u
3 JOIN ReserveReturn rr ON u.UserID = rr.UserID
4 JOIN Books b ON rr.ISBN = b.ISBN;
5

```

Results Explain Describe Saved SQL History

FIRSTNAME	LASTNAME	EMAIL	TITLE
Alice	Johnson	alice@example.com	Introduction to SQL
Bob	Smith	bob@example.com	Python Programming
Charlie	Brown	charlie@example.com	Data Structures and Algorithms

3 rows returned in 0.04 seconds Download

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6. List All Books with Their Current Status (Issued/Returned):

SELECT b.Title, r.IssueReturn

FROM Books b

LEFT JOIN Reports r ON b.ISBN = r.Book_no

ORDER BY b.Title;

APEX App Builder SQL Workshop Team Development Gallery Search PB Parikshya Bhandari parikshya098

SQL Commands Schema WKSP_PARIKSHYA098

Language SQL Rows 10 Clear Command Find Tables Save Run

```

1 SELECT b.Title, r.IssueReturn
2 FROM Books b
3 LEFT JOIN Reports r ON b.ISBN = r.Book_no
4 ORDER BY b.Title;

```

Results Explain Describe Saved SQL History

TITLE	ISSUERETURN
Data Structures and Algorithms	Issue
Introduction to SQL	Issue
Python Programming	Return

3 rows returned in 0.05 seconds Download

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7. Report Overdue Books with User Contact Information:

```

SELECT b.Title, rr.DueDate, r.Firstname, r.Lastname, r.Phone_no

FROM Books b

JOIN ReserveReturn rr ON b.ISBN = rr.ISBN

JOIN Readers r ON rr.UserID = r.UserID

WHERE rr.ReturnDate IS NULL AND rr.DueDate < SYSDATE;

```

The screenshot displays the Oracle APEX SQL Workshop interface. The SQL command window contains the following query:

```

1 SELECT b.Title, rr.DueDate, r.Firstname, r.Lastname, r.Phone_no
2 FROM Books b
3 JOIN ReserveReturn rr ON b.ISBN = rr.ISBN
4 JOIN Readers r ON rr.UserID = r.UserID
5 WHERE rr.ReturnDate IS NULL AND rr.DueDate < SYSDATE;

```

The Results tab shows the following data:

TITLE	DUEDATE	FIRSTNAME	LASTNAME	PHONE_NO
Introduction to SQL	03/15/2024	Alice	Johnson	123-456-7890
Python Programming	03/20/2024	Bob	Smith	456-789-0123
Data Structures and Algorithms	03/25/2024	Charlie	Brown	789-012-3456

3 rows returned in 0.05 seconds

8. History of a Book (Issues and Returns):

```

SELECT r.Reg_no, r.Book_no, r.IssueReturn, r.User_id

FROM Reports r

WHERE r.Book_no = 'ISBN123456';

```

The screenshot shows the Oracle APEX SQL Workshop interface. At the top, there's a navigation bar with 'APEX', 'App Builder', 'SQL Workshop', 'Team Development', and 'Gallery'. A search bar and user profile 'Parikshya Bhandari' are also present. Below this, the 'SQL Commands' section shows a query:

```
1 SELECT r.Reg_no, r.Book_no, r.IssueReturn, r.User_id
2 FROM Reports r
3 WHERE r.Book_no = 'ISBN123456';
4
```

 The 'Results' tab is active, displaying a table with 4 columns: REG_NO, BOOK_NO, ISSUERETURN, and USER_ID. The table contains one row: 1, ISBN123456, Issue, 101. Below the table, it says '1 rows returned in 0.01 seconds' and has a 'Download' link. The footer shows 'Copyright © 1999, 2023, Oracle and/or its affiliates.' and 'Oracle APEX 23.2.4'.

REG_NO	BOOK_NO	ISSUERETURN	USER_ID
1	ISBN123456	Issue	101

Trigger: Update Status on Book Return

CREATE OR REPLACE TRIGGER UpdateIssueReturn

AFTER UPDATE OF ReturnDate ON ReserveReturn

FOR EACH ROW

BEGIN

 UPDATE Reports r

 SET r.IssueReturn = 'Return'

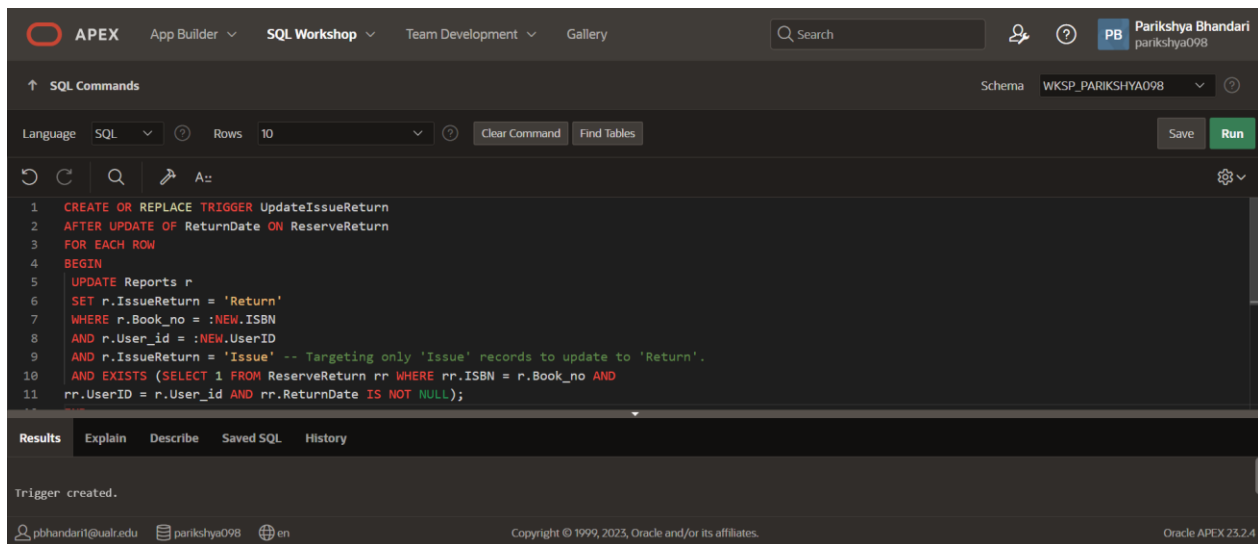
 WHERE r.Book_no = :NEW.ISBN

 AND r.User_id = :NEW.UserID

 AND r.IssueReturn = 'Issue' -- Targeting only 'Issue' records to update to 'Return'.

 AND EXISTS (SELECT 1 FROM ReserveReturn rr WHERE rr.ISBN =
 r.Book_no AND rr.UserID = r.User_id AND rr.ReturnDate IS NOT NULL);

END;



Procedures or Functions: Procedure to Issue a Book

```
CREATE OR REPLACE PROCEDURE IssueBook(p_user_id INT, p_isbn VARCHAR,  
p_staff_id INT, p_reserve_date DATE, p_due_date DATE) IS v_reg_no INT;
```

```
BEGIN
```

```
    SELECT MAX(Reg_no) + 1 INTO v_reg_no FROM Reports;
```

```
    INSERT INTO Reports (Reg_no, Book_no, IssueReturn, User_id, Staff_id)  
    VALUES (v_reg_no, p_isbn, 'Issue', p_user_id, p_staff_id);
```

```
    INSERT INTO ReserveReturn (ReserveDate, DueDate, UserID, ISBN) VALUES  
    (p_reserve_date, p_due_date, p_user_id, p_isbn);
```

```
EXCEPTION
```

```
    WHEN OTHERS THEN DBMS_OUTPUT.PUT_LINE(SQLERRM);
```

```
END;
```

The screenshot displays the Oracle APEX SQL Workshop interface. At the top, the navigation bar includes 'APEX', 'App Builder', 'SQL Workshop', 'Team Development', and 'Gallery'. A search bar and user profile 'Parikshya Bhandari' are also present. The main area is titled 'SQL Commands' and shows a PL/SQL procedure named 'IssueBook'. The procedure logic is as follows:

```
1 CREATE OR REPLACE PROCEDURE IssueBook(p_user_id INT, p_isbn VARCHAR, p_staff_id INT, p_reserve_date DATE, p_due_date DATE) IS v_reg_no INT;  
2 BEGIN  
3   SELECT MAX(Reg_no) + 1 INTO v_reg_no FROM Reports;  
4   INSERT INTO Reports (Reg_no, Book_no, IssueReturn, User_id, Staff_id) VALUES (v_reg_no, p_isbn, 'Issue', p_user_id, p_staff_id);  
5   INSERT INTO ReserveReturn (ReserveDate, DueDate, UserID, ISBN) VALUES (p_reserve_date, p_due_date, p_user_id, p_isbn);  
6 EXCEPTION  
7   WHEN OTHERS THEN DBMS_OUTPUT.PUT_LINE(SQLERRM);  
8 END;
```

Below the code editor, the 'Results' tab is active, displaying the message 'Procedure created.' and the execution time '0.06 seconds'. The bottom status bar shows the user email 'pbhandari1@ual.edu', workspace 'parikshya098', and Oracle APEX version '23.2.4'.

CONCLUSION:

The development of the Library Management System through these phases represents a significant enhancement in library management and user interaction. By transitioning from traditional methods to a sophisticated database system, the project not only improves operational efficiency but also enhances user engagement. As libraries continue to serve as vital resources for information and learning, the LMS ensures they remain relevant and accessible in the digital age, aligning with current trends in database technology and setting a foundation for future enhancements.