Library Management System

Introduction:

The Library Management System is a system that shows all the available books and their count and also books taken by people, the date on which they took that book, expected date of return, late due fees, membership details, and so on. Everything will be crystal clear. There will be no ambiguity. It will be beneficial for both students and librarians. Designing a library management system involves creating a database schema and writing SQL queries to manage the library's data. In this project, we'll focus on the basic components of a library management system, including tables for books, members, and borrowing transactions.

This library management is very efficient and also cost-effective. It saves a lot of time for both librarians and students. With this, manual work is reduced, requiring less staff and maintenance.

This system is user-friendly and also very easy to use.

Below is a simplified SQL project outline for a library management system:

Create Databases:

```
MariaDB [(none)]> CREATE DATABASE LibraryManagement;
Query OK, 1 row affected (0.002 sec)
```

Create Tables:

```
MariaDB [(none)]> use LibaryManagement;
ERROR 1049 (42000): Unknown database 'libarymanagement'
MariaDB [(none)]> use LibraryManagement;
Database changed
MariaDB [LibraryManagement]> CREATE TABLE books (
    ->     book_id INT PRIMARY KEY,
    ->     title VARCHAR(100),
    ->     author VARCHAR(100),
    ->     genre VARCHAR(50),
    ->     total_copies INT,
    ->     available_copies INT
    -> );
Query OK, 0 rows affected (0.023 sec)

MariaDB [LibraryManagement]>
MariaDB [LibraryManagement]> CREATE TABLE members (
    ->     member_id INT PRIMARY KEY,
    ->     name VARCHAR(100),
    ->     email VARCHAR(100),
    ->     phone VARCHAR(20)
    -> );
Query OK, 0 rows affected (0.024 sec)

MariaDB [LibraryManagement]>
MariaDB [LibraryManagement]> CREATE TABLE transactions (
    ->     transaction_id INT PRIMARY KEY,
    ->     book_id INT,
    ->     member_id INT,
    ->     borrow_date DATE,
    ->     due_date DATE,
    ->     return_date DATE,
    ->     FOREIGN KEY (book_id) REFERENCES books (book_id),
    ->     FOREIGN KEY (member_id) REFERENCES members (member_id)
    -> );
Query OK, 0 rows affected (0.052 sec)
```

Show Table:

```
MariaDB [LibraryManagement]> show tables;
+-----------------------------+
| Tables_in_librarymanagement |
+-----------------------------+
| books                       |
| members                     |
| transactions                |
+-----------------------------+
3 rows in set (0.002 sec)
```

Insert Data:

```
MariaDB [LibraryManagement]> INSERT INTO books (book_id, title, author, genre, total_copies, available_copies)
    -> VALUES
    ->     (1, 'Book A', 'Author A', 'Fiction', 5, 5),
    ->     (2, 'Book B', 'Author B', 'Mystery', 3, 3),
    ->     (3, 'Book C', 'Author C', 'Science', 8, 8);
Query OK, 3 rows affected (0.151 sec)
Records: 3  Duplicates: 0  Warnings: 0

MariaDB [LibraryManagement]>
MariaDB [LibraryManagement]> INSERT INTO members (member_id, name, email, phone)
    -> VALUES
    ->     (1, 'John Doe', 'john@example.com', '123-456-7890'),
    ->     (2, 'Jane Smith', 'jane@example.com', '987-654-3210');
Query OK, 2 rows affected (0.022 sec)
Records: 2  Duplicates: 0  Warnings: 0
```

Describe Tables:

```
MariaDB [LibraryManagement]> describe books;
+------------------+--------------+------+-----+---------+-------+
| Field            | Type         | Null | Key | Default | Extra |
+------------------+--------------+------+-----+---------+-------+
| book_id          | int(11)      | NO   | PRI | NULL    |       |
| title            | varchar(100) | YES  |     | NULL    |       |
| author           | varchar(100) | YES  |     | NULL    |       |
| genre            | varchar(50)  | YES  |     | NULL    |       |
| total_copies     | int(11)      | YES  |     | NULL    |       |
| available_copies | int(11)      | YES  |     | NULL    |       |
+------------------+--------------+------+-----+---------+-------+
6 rows in set (0.019 sec)

MariaDB [LibraryManagement]> describe members;
+-----------+--------------+------+-----+---------+-------+
| Field     | Type         | Null | Key | Default | Extra |
+-----------+--------------+------+-----+---------+-------+
| member_id | int(11)      | NO   | PRI | NULL    |       |
| name      | varchar(100) | YES  |     | NULL    |       |
| email     | varchar(100) | YES  |     | NULL    |       |
| phone     | varchar(20)  | YES  |     | NULL    |       |
+-----------+--------------+------+-----+---------+-------+
4 rows in set (0.024 sec)
```

Display the tables in the database:

```
MariaDB [LibraryManagement]> SELECT * FROM books;
+---------+--------+----------+---------+--------------+------------------+
| book_id | title  | author   | genre   | total_copies | available_copies |
+---------+--------+----------+---------+--------------+------------------+
|       1 | Book A | Author A | Fiction |            5 |                2 |
|       2 | Book B | Author B | Mystery |            3 |                3 |
|       3 | Book C | Author C | Science |            8 |                9 |
+---------+--------+----------+---------+--------------+------------------+
3 rows in set (0.001 sec)

MariaDB [LibraryManagement]> SELECT * FROM members;
+-----------+------------+------------------+--------------+
| member_id | name       | email            | phone        |
+-----------+------------+------------------+--------------+
|         1 | John Doe   | john@example.com | 123-456-7890 |
|         2 | Jane Smith | jane@example.com | 987-654-3210 |
+-----------+------------+------------------+--------------+
2 rows in set (0.000 sec)

MariaDB [LibraryManagement]> SELECT * FROM transactions;
+----------------+---------+-----------+-------------+------------+-------------+
| transaction_id | book_id | member_id | borrow_date | due_date   | return_date |
+----------------+---------+-----------+-------------+------------+-------------+
|              0 |       1 |         1 | 2023-07-30  | 2023-08-06 | NULL        |
+----------------+---------+-----------+-------------+------------+-------------+
1 row in set (0.000 sec)
```

Alter table - Add columns:

```
MariaDB [LibraryManagement]> ALTER TABLE books
    -> ADD COLUMN publisher VARCHAR(100);
Query OK, 0 rows affected (0.026 sec)
Records: 0  Duplicates: 0  Warnings: 0

MariaDB [LibraryManagement]> SELECT * FROM books;
+---------+--------+----------+---------+--------------+------------------+-----------+
| book_id | title  | author   | genre   | total_copies | available_copies | publisher |
+---------+--------+----------+---------+--------------+------------------+-----------+
|       1 | Book A | Author A | Fiction |            5 |                2 | NULL      |
|       2 | Book B | Author B | Mystery |            3 |                3 | NULL      |
|       3 | Book C | Author C | Science |            8 |                9 | NULL      |
+---------+--------+----------+---------+--------------+------------------+-----------+
3 rows in set (0.000 sec)

MariaDB [LibraryManagement]>
```

Alter table - Drop column:

```
MariaDB [librarymanagement]> ALTER TABLE members
    -> DROP COLUMN phone;
Query OK, 0 rows affected (0.025 sec)
Records: 0  Duplicates: 0  Warnings: 0

MariaDB [librarymanagement]> select * from members;
+-----------+------------+------------------+
| member_id | name       | email            |
+-----------+------------+------------------+
|         1 | John Doe   | john@example.com |
|         2 | Jane Smith | jane@example.com |
+-----------+------------+------------------+
2 rows in set (0.000 sec)
```

Rename a table:

```
MariaDB [librarymanagement]> ALTER TABLE transactions
    -> RENAME TO borrowed_books;
Query OK, 0 rows affected (0.026 sec)
```

```
MariaDB [librarymanagement]> show tables;
+-----------------------------+
| Tables_in_librarymanagement |
+-----------------------------+
| books                       |
| borrowed_books              |
| members                     |
+-----------------------------+
3 rows in set (0.001 sec)
```

Truncate a table:

```
MariaDB [librarymanagement]> TRUNCATE TABLE borrowed_books;
Query OK, 0 rows affected (0.072 sec)
```

Delete data from a table:

```
MariaDB [librarymanagement]> DELETE FROM members WHERE member_id = 4;
Query OK, 1 row affected (0.005 sec)
```

Update data in a table

```
MariaDB [librarymanagement]> UPDATE books
    -> SET genre = 'Science Fiction'
    -> WHERE book_id = 1;
Query OK, 1 row affected (0.007 sec)
Rows matched: 1  Changed: 1  Warnings: 0

MariaDB [librarymanagement]>
```

Order by and Limit queries:

```
MariaDB [librarymanagement]> SELECT * FROM books
    -> ORDER BY title ASC
    -> LIMIT 10;
+---------+--------+----------+-----------------+--------------+-----------------+-----------+
| book_id | title  | author   | genre           | total_copies | available_copies | publisher |
+---------+--------+----------+-----------------+--------------+-----------------+-----------+
|       1 | Book A | Author A | Science Fiction |            5 |               2 | NULL      |
|       2 | Book B | Author B | Mystery         |            3 |               3 | NULL      |
|       3 | Book C | Author C | Science         |            8 |               9 | NULL      |
+---------+--------+----------+-----------------+--------------+-----------------+-----------+
3 rows in set (0.001 sec)
```

Select query with specific columns:

```
MariaDB [librarymanagement]> SELECT title, author FROM books
    -> WHERE genre = 'Mystery';
+--------+----------+
| title  | author   |
+--------+----------+
| Book B | Author B |
+--------+----------+
1 row in set (0.000 sec)
```

Select query with column name change:

```
MariaDB [librarymanagement]> SELECT title, author FROM books
    -> WHERE genre = 'Mystery';
+--------+----------+
| title  | author   |
+--------+----------+
| Book B | Author B |
+--------+----------+
1 row in set (0.000 sec)
```

Using WHERE, Comparison operators, AND, OR:

```
MariaDB [librarymanagement]> SELECT * FROM books
    -> WHERE genre = 'Mystery' AND available_copies >= 3;
+---------+--------+----------+---------+--------------+------------------+-----------+
| book_id | title  | author   | genre   | total_copies | available_copies | publisher |
+---------+--------+----------+---------+--------------+------------------+-----------+
|       2 | Book B | Author B | Mystery |            3 |                3 | NULL      |
+---------+--------+----------+---------+--------------+------------------+-----------+
1 row in set (0.000 sec)
```

```
MariaDB [librarymanagement]> SELECT * FROM books
    -> WHERE genre = 'Science' OR available_copies < 9;
+---------+--------+----------+-----------------+--------------+------------------+-----------+
| book_id | title  | author   | genre           | total_copies | available_copies | publisher |
+---------+--------+----------+-----------------+--------------+------------------+-----------+
|       1 | Book A | Author A | Science Fiction |            5 |                2 | NULL      |
|       2 | Book B | Author B | Mystery         |            3 |                3 | NULL      |
|       3 | Book C | Author C | Science         |            8 |                9 | NULL      |
+---------+--------+----------+-----------------+--------------+------------------+-----------+
3 rows in set (0.000 sec)
```

Using BETWEEN clause:

```
MariaDB [librarymanagement]> SELECT book_id, borrow_date
    -> FROM borrowed_books
    -> WHERE borrow_date BETWEEN '2023-07-30' AND '2023-08-05';
+---------+-------------+
| book_id | borrow_date |
+---------+-------------+
|       1 | 2023-07-30  |
+---------+-------------+
1 row in set (0.000 sec)
```

Using COUNT and SUM functions with IN clause:

```
MariaDB [librarymanagement]> SELECT COUNT(*) AS total_books
    -> FROM books
    -> WHERE genre IN ('Fiction', 'Mystery');
+-------------+
| total_books |
+-------------+
|           1 |
+-------------+
1 row in set (0.000 sec)

MariaDB [librarymanagement]>
```

```
MariaDB [librarymanagement]> SELECT SUM(available_copies) AS total_available_copies
    -> FROM books
    -> WHERE genre IN ('Fiction', 'Mystery');
+------------------------+
| total_available_copies |
+------------------------+
|                      3 |
+------------------------+
1 row in set (0.000 sec)
```

Group by and Aggregate functions:

```
MariaDB [librarymanagement]> SELECT genre, AVG(available_copies) AS average_copies
    -> FROM books
    -> GROUP BY genre;
+-----------------+----------------+
| genre           | average_copies |
+-----------------+----------------+
| Mystery         |         3.0000 |
| Science         |         9.0000 |
| Science Fiction |         2.0000 |
+-----------------+----------------+
3 rows in set (0.001 sec)
```

Using LIKE operator:

```
MariaDB [librarymanagement]> SELECT * FROM books
    -> WHERE title LIKE 'The%';
Empty set (0.000 sec)

MariaDB [librarymanagement]> SELECT * FROM books
    -> WHERE title LIKE 'Book C';
+---------+--------+----------+---------+--------------+-----------------+-----------+
| book_id | title  | author   | genre   | total_copies | available_copies | publisher |
+---------+--------+----------+---------+--------------+-----------------+-----------+
|       3 | Book C | Author C | Science |            8 |               9 | NULL      |
+---------+--------+----------+---------+--------------+-----------------+-----------+
1 row in set (0.000 sec)
```

Using UNION:

```
MariaDB [librarymanagement]> SELECT book_id AS id, title AS name FROM books
    -> UNION
    -> SELECT member_id AS id, name FROM members;
+----+------------+
| id | name       |
+----+------------+
|  1 | Book A     |
|  2 | Book B     |
|  3 | Book C     |
|  1 | John Doe   |
|  2 | Jane Smith |
+----+------------+
5 rows in set (0.000 sec)
```

Using Joins:

```
MariaDB [librarymanagement]> SELECT books.title AS book_title, members.name AS member_name
    -> FROM books
    -> JOIN borrowed_books ON books.book_id = borrowed_books.book_id
    -> JOIN members ON borrowed_books.member_id = members.member_id;
+------------+-------------+
| book_title | member_name |
+------------+-------------+
| Book A     | John Doe    |
+------------+-------------+
1 row in set (0.001 sec)
```

Using Sub query:

```
MariaDB [librarymanagement]> SELECT name FROM members WHERE member_id IN ( SELECT DISTINCT member_id FROM borrowed_books );
+----------+
| name     |
+----------+
| John Doe |
+----------+
1 row in set (0.001 sec)
```

Creating Views:

```
MariaDB [librarymanagement]> CREATE VIEW fiction_books AS
    -> SELECT *
    -> FROM books
    -> WHERE genre = 'Fiction' AND available_copies > 3;
Query OK, 0 rows affected (0.016 sec)
```

```
MariaDB [librarymanagement]> SELECT * FROM fiction_books;
Empty set (0.022 sec)
```