DATABASE MANAGEMENT SYSTEM - CSA0593

ASSIGNMENT 4

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QUESTION:

"Design and implement a database management system for a library to efficiently manage book inventory, track book loans, and analyze borrowing trends.Model tables for books, authors, members, and book loans.

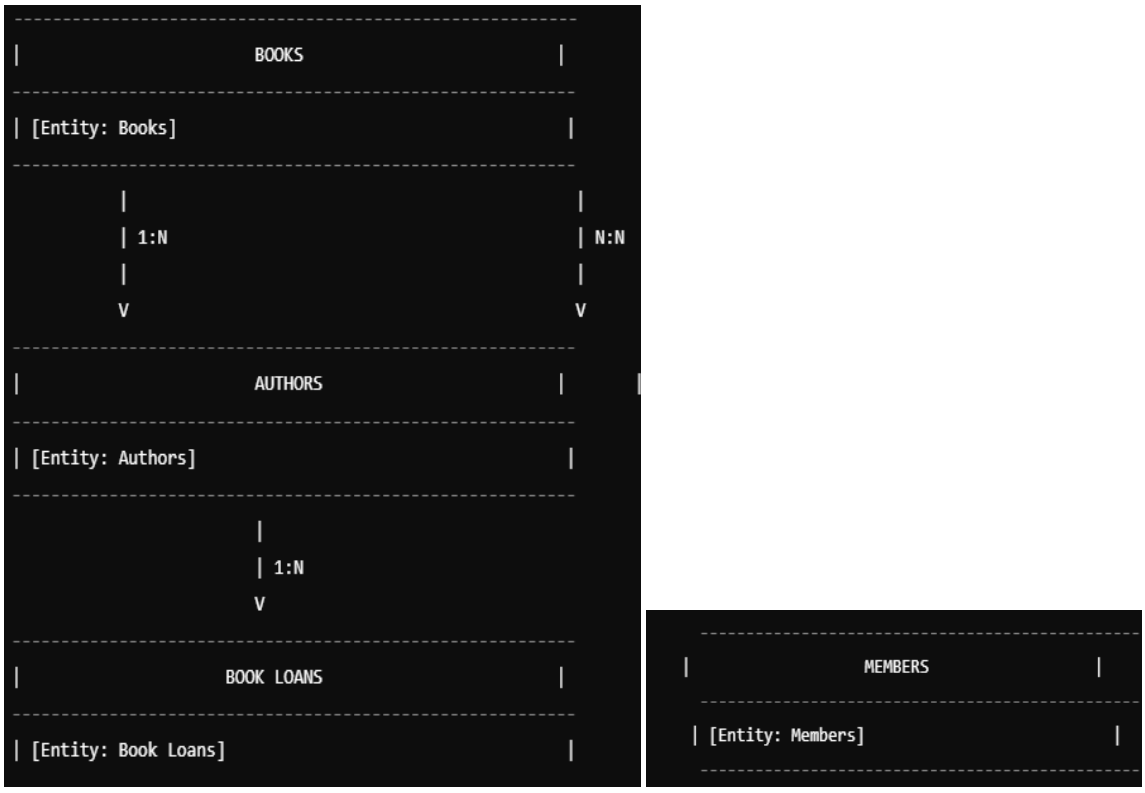
Write stored procedures to lend and return books.

Implement triggers to update book availability and track overdue loans.

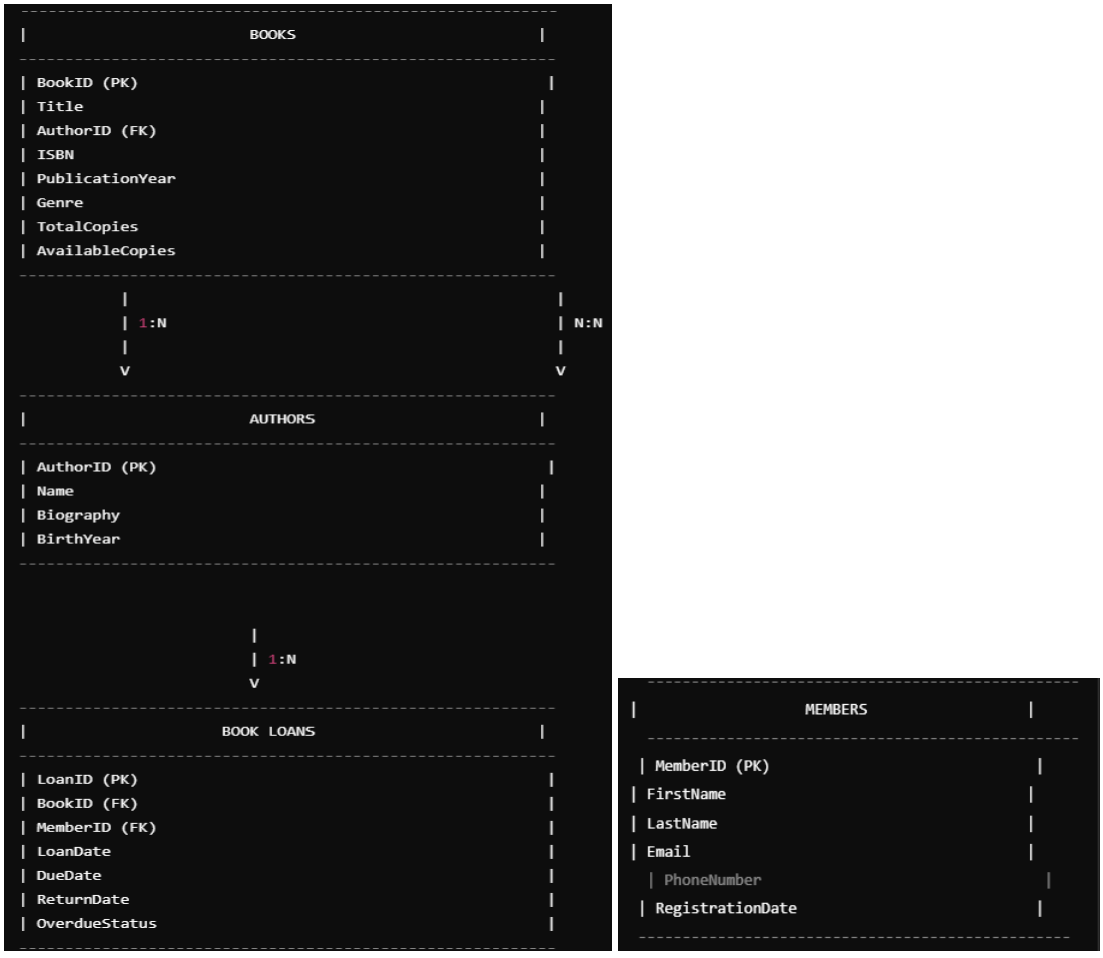
Write SQL queries to analyze book popularity and member borrowing habits."

ANSWER:

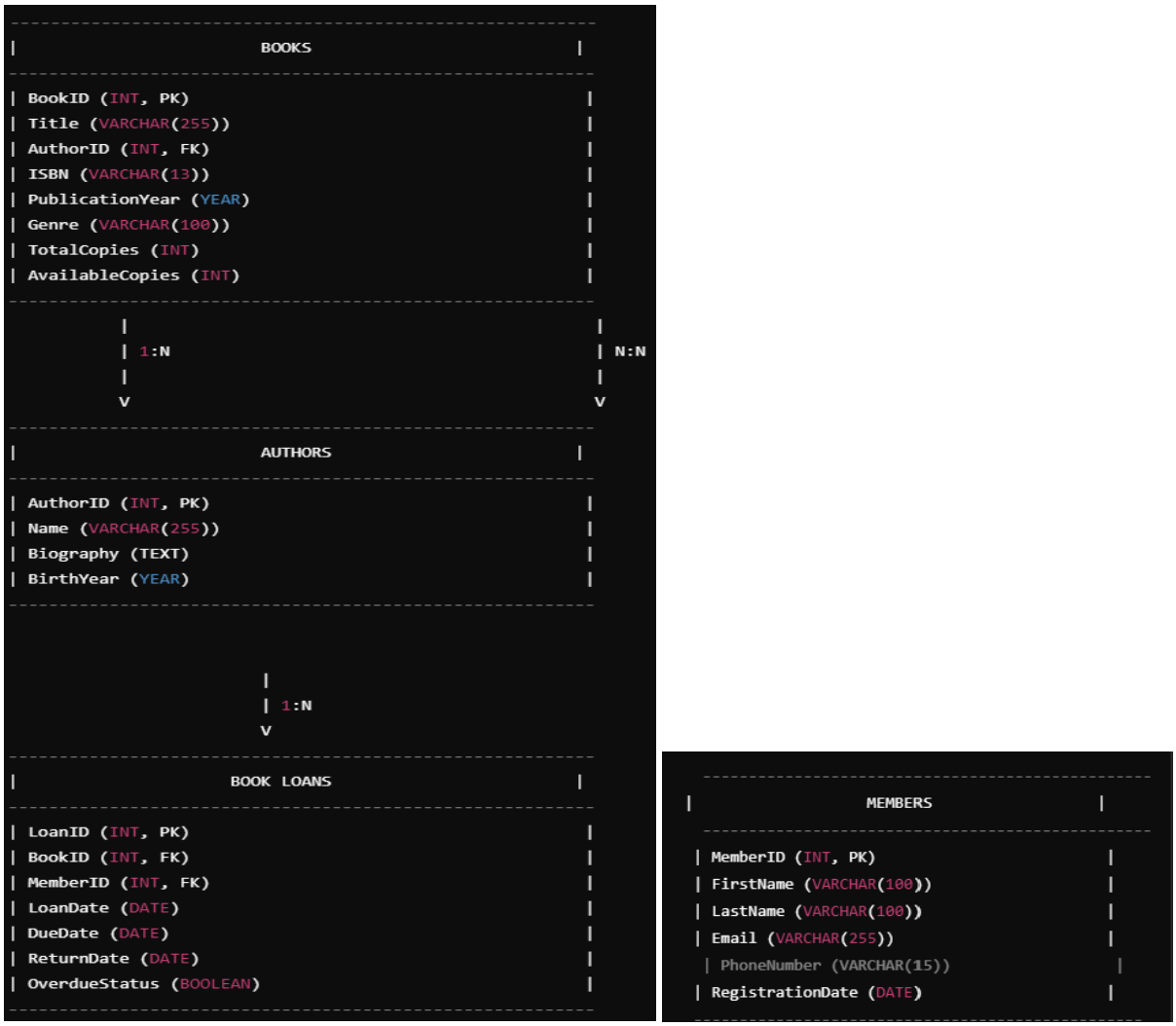
CONCEPTUAL E.R.DIAGRAM:



LOGICAL E.R.DIAGRAM:



PHYSCIAL E.R.DIAGRAM:



MYSQL STATEMENTS:

Database Design

```
CREATE DATABASE library_management;

USE library_management;

CREATE TABLE authors (
  author_id INT PRIMARY KEY,
  author_name VARCHAR(255)
);

CREATE TABLE books (
  book_id INT PRIMARY KEY,
  title VARCHAR(255),
  author_id INT,
  publication_date DATE,
  ISBN VARCHAR(20),
  availability INT,
  FOREIGN KEY (author_id) REFERENCES authors(author_id)
);

CREATE TABLE members (
  member_id INT PRIMARY KEY,
  name VARCHAR(255),
  email VARCHAR(255),
  phone VARCHAR(20),
```

```
  address VARCHAR(255)
);

CREATE TABLE book_loans (
  loan_id INT PRIMARY KEY,
  book_id INT,
  member_id INT,
  loan_date DATE,
  return_date DATE,
  status VARCHAR(20),
  FOREIGN KEY (book_id) REFERENCES books(book_id),
  FOREIGN KEY (member_id) REFERENCES members(member_id)
);
```

Stored Procedures

```
DELIMITER //

CREATE PROCEDURE lend_book(
  IN book_id INT,
  IN member_id INT,
  IN loan_date DATE,
  IN return_date DATE
)
```

```
BEGIN
  DECLARE available_books INT;
  SELECT availability INTO available_books
  FROM books
  WHERE book_id = book_id;

  IF available_books > 0 THEN
    INSERT INTO book_loans (book_id, member_id, loan_date, return_date,
status)
    VALUES (book_id, member_id, loan_date, return_date, 'Lent');

    UPDATE books
    SET availability = availability - 1
    WHERE book_id = book_id;
  ELSE
    SIGNAL SQLSTATE '45000' SET MESSAGE_TEXT = 'Book not available';
  END IF;
END //

CREATE PROCEDURE return_book(
  IN loan_id INT
)
BEGIN
  DECLARE book_id INT;
  SELECT book_id INTO book_id
  FROM book_loans
  WHERE loan_id = loan_id;
```

```
  UPDATE books
  SET availability = availability + 1
  WHERE book_id = book_id;

  UPDATE book_loans
  SET status = 'Returned'
  WHERE loan_id = loan_id;
END //
```

Triggers

```
DELIMITER //

CREATE TRIGGER update_book_availability
AFTER INSERT ON book_loans
FOR EACH ROW
BEGIN
  UPDATE books
  SET availability = availability - 1
  WHERE book_id = NEW.book_id;
END //

CREATE TRIGGER track_overdue_loans
```

```
AFTER UPDATE ON book_loans
FOR EACH ROW
BEGIN
  IF NEW.status = 'Overdue' THEN
    -- Send notification to member
  END IF;
END //



SQL Queries



-- Analyze book popularity
SELECT
  books.title,
  COUNT(book_loans.loan_id) AS number_of_loans
FROM
  books
  JOIN book_loans ON books.book_id = book_loans.book_id
GROUP BY
  books.title
ORDER BY
  number_of_loans DESC;

-- Member borrowing habits
SELECT
```

```
  members.name,
  COUNT(book_loans.loan_id) AS number_of_loans,
  SUM(DATEDIFF(book_loans.return_date, book_loans.loan_date)) /
COUNT(book_loans.loan_id) AS average_loan_duration
FROM
  members
  JOIN book_loans ON members.member_id = book_loans.member_id
GROUP BY
  members.name;
```

Conclusion:

Designing a database management system for a library requires careful consideration of various factors.

Key benefits of this system include:

1. Efficient book inventory management.
2. Automated tracking of book loans and returns.
3. Data-driven insights into book popularity and member borrowing habits.

By implementing this database management system, libraries can improve operational efficiency, enhance member experiences, and promote a love of reading.