Project Overview: Library Database Analysis

The goal of this project was to build and analyze a relational database for a library. The project involved two main phases: first, designing and creating a well-structured database to store all library information, and second, writing complex SQL queries to extract meaningful insights and answer specific business questions. The project allowed me to showcase my proficiency in data modeling, SQL query writing, and data manipulation.

Step 1: Database and Table Creation

The initial step was to create the database schema based on the provided data model[1]. I used a relational database management system to set up the necessary tables and define the relationships between them[2].

- **Database Schema:** I designed seven tables: publisher, borrower, library_branch, books, book_authors, book_copies, and book_loans. Each table was created to store specific information, from book details to borrower data and loan transactions.
- **Constraints and Integrity:** To ensure data integrity, I implemented several key constraints. Each table was given a

  primary key to uniquely identify records[3].

  Foreign keys were used to create relationships between tables, such as linking a book to its publisher and an author to their book[4]. A crucial aspect of this was using the

  ON DELETE CASCADE clause for foreign keys, which automatically deletes related child records when a parent record is removed, maintaining data consistency[5]. I also added an

  auto-increment constraint to all primary keys to ensure new records are assigned unique IDs automatically[6].

Step 2: Data Import and Validation

After creating the database structure, the next logical step was to import the data into the tables. This phase required careful validation to ensure that the column names in the CSV files matched the column names in the database tables[7]. This attention to detail is critical for a smooth and accurate data import process.

Step 3: SQL Data Analysis

The core of the project was writing and executing SQL queries to perform data analysis and answer specific questions posed in the project requirements[8]. This phase demonstrated my ability to use various SQL commands and functions to solve real-world problems.

Here are some examples of the queries I wrote:

1. **Inventory Management:** To find how many copies of "The Lost Tribe" are at the "Sharpstown" branch, I performed an **INNER JOIN** on the books, book_copies, and library_branch tables. I used a

   WHERE clause to filter the results by book title and branch name[9].

2. **Borrower Insights:** To identify borrowers with no books checked out, I used a **LEFT JOIN** between the borrower and book_loans tables. This allowed me to find all borrowers and their loan records. I then used a
   WHERE clause to filter for records where the loan information was NULL, indicating

   no books were checked out[10].

3. **Complex Loan Queries:** I used a multi-table **INNER JOIN** to retrieve a book's title, a borrower's name, and their address for all books loaned out from the "Sharpstown" branch with a specific due date. This query required joining four tables to gather all

   the necessary information[11].

4. **Performance Metrics:** To determine the total number of books loaned out from each branch, I used an **INNER JOIN** along with a **GROUP BY** clause. The
   GROUP BY function allowed me to aggregate the loan counts for each individual

   branch[12].

5. **Advanced Filtering:** To find borrowers with more than five books checked out, I used a **LEFT JOIN** and then applied a **HAVING clause**. The
   HAVING clause is a powerful tool used to filter groups created by GROUP BY,

   allowing me to find borrowers with a loan count greater than five[13].

6. **Specific Author Analysis:** To find how many copies of books by "Stephen King" are at the "Central" branch, I joined four tables and used a WHERE clause to filter the

   results by both the author's name and the branch name[14].

Project Outcome and Skills Demonstrated

This project was a success, as I was able to build a functional and well-structured database

and use SQL to answer all the specified questions[15].

The key skills I demonstrated through this project are:

- **Database Design and Data Modeling:** I successfully created a relational schema with appropriate primary and foreign keys.
- **SQL Proficiency:** I wrote complex queries using JOINs, GROUP BY, HAVING, and other functions to extract specific data and generate reports.
- **Data Integrity:** I used constraints like **ON DELETE CASCADE** and auto_increment to ensure the database remained consistent and reliable.

Overall, this project showcases my ability to transition from a conceptual data model to a fully implemented, queryable database solution that provides valuable business insights.