National University of Singapore
School of Computing

BT2102 Data Management and Visualisation

Assignment 1 (Group Project):
Integrated Library System (ILS)

Total marks: 40

BACKGROUND INFORMATION

A public library in Singapore has seen an increase in the number of library members (i.e., those who borrow books from the library) recently. To streamline the lending process of books and to reduce the workloads of the administrative staff, the library management has decided to incorporate a new Integrated Library System. The library's in-house IT team is expected to deliver a database software application (named "ILS") that can manage book borrowing, returning and other related operations efficiently and effectively.

FUNCTIONAL REQUIREMENTS

The application must support both library lending transactions as well as the efficient management of book records. To facilitate the development of the application, the management has specified the following key functions that the application is expected to support.

User Registration and Login

There are two types of user: *member users* and *administrative users*. Administrative users are created in the backend, while member users can register an account on the application login page with a unique user ID and password. Both member users and administrative users need to login with their respective user ID and password to access the system.

Book Search

Member users can conduct simple or advanced search for books to check their availability. In simple search, the user specifies the keyword(s). The search result returns a list of book records whose title contains at least one of the keywords entered. Each returned record should contain the book ID, title, availability (i.e., available, or not available (because it is borrowed or taken out of circulation)) and expected due date (if applicable) of the book. If the book is currently borrowed by other users, the member user can reserve the book. If it is available, the member user can proceed to borrow the book. In advanced search, users can specify several filters (e.g., authors, category, publisher, year of publication, etc.) as search criteria.

Book Borrowing

If a book status is available, the user can borrow the book. A user can borrow a book for four weeks at a time and he/she can borrow up to a maximum of four books.

Book Reservation

To make a request to reserve a book, the application needs to check whether the book has been reserved by another member. If the book is not reserved, the member user can proceed to reserve the book.

Borrowing, Returning and Reservation Management

A dedicated management function allows the member user to manage all his/her books currently borrowed or reserved. The user can return or extend the due date of return of the borrowed book. Any extension is for a four-week extension from the stated due date, provided there is no reservation on the book by other users. The user can also cancel a reservation at any time or convert the reservation to borrowing when the book becomes available.

Fines and Payments

The library charges a fine of $1 per book per day if the member user fails to return a borrowed book on the stipulated due date. If the user has any unpaid fines, the user is not allowed to make any further borrowings or reservations. Also, any outstanding reservations will be cancelled automatically by the system. Payment of fine can only be made online with credit or debit card.

Administrative Function

If the login user is an administrative user, the user can access additional administrative function that is not available to member user. This function allows administrative users to easily display at least three key information: all current book borrowings (including overdue ones), all current book reservations, and all users with unpaid fines.

DESIGN REQUIREMENTS

Considering the huge volume of books this library is expected to store in the future, the IT team decides to use **both MySQL and MongoDB databases** to improve efficiency and performance. More specifically, the MySQL database is used to support library transactions such as book borrowing, returning, and reservation, while the MongoDB database is used to support fast and efficient book search function. All book meta information (such as book ID, title, authors, publishers, publication date, page, description, category, ISBN, etc.) are stored as book collection in MongoDB and book search function will be directly implemented on MongoDB database. The MySQL database stores book information (such as book ID, borrow status, reservation status, etc.) required to support book borrowing, returning, reservation and other related transactions.

PROJECT GUIDELINES

1. Develop a conceptual data model and logical data model for the relational database to be implemented on a MySQL database. The steps include:
    a. Identify entities, their associated attributes and primary key attribute(s) based on the functional requirements.
    b. Identify the relationships, their attributes and cardinality.
    c. Produce an Entity-Relationship Diagram for the conceptual data model.
    d. Translate the Entity-Relationship Diagram into relational schemas.
    e. Refine the relational schemas by normalization or combining schemas where possible to produce the final logical data model.
2. Implement the relational database on MySQL based on the final logical data model:
    a. Produce SQL scripts to create tables and specify all essential constraints.
    b. You are not required to design and implement the book collection in MongoDB, a sample book collection (of about 400 records) is provided (and is available as books.json file in the Luminus->Files->Assignments->Assignment 1 folder) for development and testing of the search function. You may use the information in the collection for the relational database records.
3. Develop the ILS as a software application that can connect to both databases and provide for all the required functions (for member users and administrative users) in the system:
    a. You must develop the ILS system primarily in Python.
    b. The ILS system can be a standalone or web-based application.
    c. User-friendliness in the design of the user interface is essential.
4. Project consultation:
    a. Project consultation is limited to the clarification of functional requirements, conceptual/logical database design, as well as MySQL and MongoDB scripting.
    b. No consultation will be provided on how to write Python code for the development of the ILS system. You are expected to learn and manage the production of the ILS system as a team on your own. However, related learning resources will be provided.

DELIVERABLES

1. A PowerPoint (or similar) presentation of the **process** to produce (i.e., the steps involved as indicated above) the conceptual and logical data model. You may annotate the PowerPoint slides with explanation on how the models are derived.
2. A demonstrable ILS system that can achieve all the required functions.
3. All codes (MySQL, MongoDB, and Python) used in this group assignment zipped into single file.

SUBMISSION

1. Zip the PowerPoint file, and the MySQL, MongoDB and Python zip file into a single zip file and name the zip file as "**GRP_XX_AS1.zip**" (for example, file name for group 9 is "GRP_09_AS1.zip" and for group 19 it is "GRP_19_AS1.zip").
2. Upload the zip file to "Assignment 1 Submission" folder in LumiNUS->Files by the assignment due date.
3. **THERE IS NO REQUIREMENT FOR YOUR GROUP TO MAKE A PRESENTATION OF THE POWERPOINT SLIDES, BUT A FACE-TO-FACE OR ZOOM DEMONSTRATION WILL BE ARRANGED INDIVIDUALLY FOR EACH GROUP IN WEEK 12 OR 13 TO EVALUATE THE ILS SYSTEM.**
4. Please be reminded that plagiarism is a serious offence. Disciplinary actions will be taken against those caught cheating.

EVALUATION

1. Your project will be evaluated on the first two deliverables:
    a. The correct development of the conceptual and logical data model. You will not be required to present the PowerPoint slides. (**15 marks**)
    b. The ILS system that can achieve all the required functions (evaluated in a face-to-face or zoom demonstration to be held individually for each group in Week 12 or 13). (**20 marks**)
    c. The ILS system UI/UX design. (**5 marks**)