

Project Description

Jungle Library is a library for all ages. Jungle Library seeks to implement a centralized relational database system to streamline and structure its operational processes. The proposed database design will incorporate the following core entities: Person, Employee, Member, Book, Publisher, Author, and Payment, ensuring data consistency, integrity, and efficient management of library resources and transactions.

A Person entity may represent either an Employee or a Member, with the possibility that Employee can also be Member. The system shall store the following attributes for each Person: Person ID, Name (First Name, Middle Name, Last Name), Address, Gender, Date of Birth, and Phone Number(s), where a Person may have multiple associated phone numbers. An Employee must be at least 18 years of age. The Person ID attribute must follow the format "PXXX", where X denotes a digit between 0 and 9.

Each Member is issued a library card, for which details such as Card ID, Issue Date, Membership Level (Silver or Gold), and other relevant information are maintained. The library may also associate Promotions with library cards. Each Promotion is defined by a unique Promotion code and an accompanying description.

Each Member is categorized as either Silver or Gold. For Gold Members, a Guest Log is maintained, capturing details such as the Gold Member's Card ID, Guest ID, Guest Name, Guest Address, and Guest Contact Information. Temporary IDs are assigned to individuals visiting as guests of a Gold Member. Each Guest ID is unique only within the scope of the associated Gold Member and is not globally unique across the entire system.

An Employee may belong to one of three categories: Library Supervisor, Cataloging Manager, or Receptionist. The system records the Employment Start Date for each Employee. A Receptionist is required to receive training from a designated Trainer, where a Trainer may be either a Library Supervisor or a Cataloging Manager. Both Library Supervisors and Cataloging Managers are permitted to train multiple Receptionists.

Details of Books, including Book ID, Book Title, and other relevant information, are maintained in the system. Books are classified into three categories: Cate. 1, Cate. 2, and Cate. 3. Each Cataloging Manager is responsible for cataloging one category per day, though they may work on different categories on different days. Additionally, a Person may leave Comments on Books, which include the Comment Time, a Rating Score (ranging from 1 to 5), and the Comment Content.

A Publisher may publish multiple Books, whereas each Book is assumed to be published by a single Publisher. The system stores Publisher details, including Publisher ID, Publisher

Name, and other relevant information (additional attributes may be defined based on requirements). Similarly, Author details, such as Author ID, Author Name, and other pertinent information, are maintained. A Book may have multiple Authors, and an Author may contribute to multiple Books.

A Receptionist is responsible for maintaining records of Borrowing details. Each record includes information about the borrowed Book, Issue Date, Due Date for Return, the Person borrowing the book, the responsible Receptionist, and associated Payment Details. Borrowing records are created only when a Person borrows a Book. Payment Details include Payment ID, Payment Method (e.g., Cash, Debit/Credit Card), Payment Time, and Amount Paid.

In addition, the Receptionist is responsible for managing Member Inquiries. Each inquiry is assigned a unique Inquiry ID and records details such as the Inquiry Time and Resolution Status. To monitor member satisfaction and engagement, Members may provide a Rating (ranging from 1 to 5) for the inquiries they have submitted.

Project Questions

1. Is the ability to model superclass/subclass relationships likely to be important in the library management system like above? Why or why not?
2. Can you think of 5 more rules (other than those explicitly described above) that are likely to be used in the above environment? Please describe how your design would be changed to satisfy your additional rules?
3. Justify the use of a Relational DBMS like Oracle for this project (Successfully design a relational database system and show all implementation in the final report at Phase IV).

Project Exercises

Phase I. Draw an EER to accurately represent this set of requirements. This will be your Conceptual Design. Clearly specify any assumptions that you are making. You can use any tools (software) to draw the EER but must use the symbols consistent with our textbook. The output of Phase I is EER diagram that satisfies the project description as much as possible. Some constraints may not be able to be specified in EER diagram, but please remember to go back to check the constraints in later phases to complete them.

Phase II. Logical Database Design. It has been decided to use a relational DBMS to implement the database. Perform the following steps.

- a. Convert your Conceptual model (Phase I, feel free to change your conceptual model if needed and draw EER after your modifications) to an implementation data model that can be implemented in a relational DBMS like Oracle. During this process you replace M-N relationships and multi-valued attributes with constructs that can be implemented in the relational DBMS.
- b. Document your design in Database Schema format, explain how you obtained your schema. The output of Phase II is the schema of database derived from your EER design. Please indicate the primary keys and foreign keys of each relation.

Phase III. Now, you are ready for implementation. Use appropriate naming conventions for all your tables and attributes.

- a. Normalize all tables to third normal form (3NF).
- b. Draw a dependency diagram for each table after normalization.
- c. Write SQL statements to create relational database and all other structures.
Primary key and foreign keys must be defined as appropriate. Also specify data type and constraints for each attribute and in addition to specify the referential integrity.
- d. Use the Create View statement to create the following views:
 1. TopGoldMember - This view returns the First Name, Last Name and Date of membership enrollment of those members who have borrowed more than 5 books in the past month.
 2. PopularBooks - This view returns the details of the most borrowed books over the past year.
 3. BestRatingPublisher – This view returns the names of publishers whose books all have at least a 4.0 average rating score.
 4. PotentialGoldMember - This view returns the name, phone number and ID of the silver members who borrowed books every month in the past year.
 5. ActiveReceptionist - This view returns the names of receptionists who resolved more than 5 inquiries from members in the past month.
- e. Write SQL statements for the following queries:
 1. List the details of all the supervisors of the library hired in the past two months.
 2. Find the names of employees who are also members and the books they have borrowed in the past month.
 3. Find the average number of books borrowed by the top five gold members in the library.

4. Find the name of the publishers and the title of the most popular book for each publisher.
5. Find names of books that were not borrowed in the last 5 months.
6. Find the members who have borrowed all the books wrote by the most popular author.
7. Find the Gold Member with the greatest number of guests.
8. Find the year with the maximum number of books borrowed.
9. Find the names of members who borrowed the most popular books.
10. List all the employees that have enrolled into gold membership within a month of being employed.
11. Find the names of receptionists with an average rating of 4.0 from the inquiries they resolved.
12. Find the names of receptionists and their trainers who resolve at least 2 inquiries every month in the past 3 months.
13. List the employee who trained the greatest number of receptionists.
14. List the Cataloging Managers who cataloged all categories every week in the past 4 weeks.

Phase IV. Document the final term project report. The report includes:

- a. Problem description (Copy it from the description).
- b. Project questions (Answer 3 questions listed in the project).
- c. EER diagram with all assumptions (Solution for Phase II).
- d. Relational Schema after normalization. All relations must be in 3NF. The relational schema should include Primary key as well as foreign keys (if any) for all relations. (Solution for Phase III a).
- e. Dependency diagram (Solution for Phase III-b).
- f. All requested SQL statements (Solution for Phase III-c, d and e).