

Database Design Term Project (CS6360)

Project Description

Wonder Library is a library for all ages. Wonder Library would like one relational database to be able to smoothly carry out their work in an organized way. The library has following modules: Person, Employee, Member, Books, Borrow details and Payment.

A Person can be an Employee or a Silver member. Details of a person such as Person ID, Name (First, Middle, Last), Address, Gender, Date of Birth (must be in year 2001 or before), and Phone number (one person can have more than one phone number) are recorded. The Person ID should have the format "PXXX" where X is a number from 0 to 9. A person with a silver membership has certain limited privileges. A person can be both an employee and a Silver member.

Each Person is issued a library card. The library card details such as card ID, date of issue, membership level and other information are stored.

Employee is further classified as Library Supervisors, Cataloging Managers or Receptionists. The start date of the employee is recorded.

A Gold member is someone who has extra privileges than a Silver member. A Gold Member can be an Employee or a Silver Member or both. Date of membership is recorded for both type of members.

A Guest log is maintained for the Gold members, which stores information such as member ID, guest ID, guest name, guest address, and guest contact information. There are temporary IDs that a person gets when they visit as a guest of a Gold member. Each guest ID is not unique and cannot be used to identify a guest in the library.

Books details such as book ID, book title and other information are stored. Books are classified as Class 1 books or Class 2 books. Silver Members can borrow up to 2 Class 1 books in a week and Gold members can borrow up to 5 Class 1 books in a week. Additionally Gold members can borrow 3 Class 2 books in a week. The cataloging manager has access to the book details.

A book is published by a publisher. A publisher can publish more than one books but a book is assumed to be published by a single publisher. The publisher details such as publisher ID and publisher name and other information are stored.

Author details such as author ID, author name and other information is stored. One book can have multiple authors and one author can write more than one book.

A receptionist maintains records. Records contain record ID and other relevant information. Borrowed book details are stored containing information about the book borrowed, the date of issue and date of return and the details about the person borrowing the book and the record ID. Borrowed details are stored only when a person borrows a book. Information about penalty payment is also stored with the details of the book, the person who borrowed and could not return within the due period. The receptionist also tracks this late fee payment records.

Project Questions

1. Is the ability to model superclass/subclass relationships likely to be important in a library environment such as Wonder Library? Why or why not?
2. Can you think of 5 more business rules (other than the one explicitly described above) that are likely to be used in a library environment? Add your rules to the above requirement to be implemented.
3. Justify using a Relational DBMS like Oracle for this project.

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.

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

- a. Convert your Conceptual model (Phase I) to a Logical 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. Draw EER for the logical model after your modifications. Feel free to change your conceptual model (first delivery) if needed.
- b. Convert the EER (item a) to a database design. Document your design in Database Schema format like the one we discussed in the class.

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

- a. Normalize all of your tables to third normal form. Make any necessary changes to the EER from Phase II b. Explain why these changes needed to be made.
- b. Draw a dependency diagram for each table from Phase III a.
- c. Write SQL statements to create database, tables and all other structures. Primary key and foreign keys must be defined as appropriate.
- d. Update data dictionary from previous delivery (phase III c.) to add data type for each attribute in addition to specifying if it is primary key, foreign key, NULL is permitted, or its value is UNIQUE.
- e. 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 a week in the past year.
 2. PopularBooks- This view returns the details of the most borrowed books over the years.

3. TopLatePaymentMembers- This view returns the details of the members who have paid the most number of late fees.
 4. PotentialGoldMember- This view returns the name, phone number and ID of the silver members who borrowed books in every week of the last month and has always returned books on time.
 5. TopPublisher- This view returns the top 5 publishers of books in the library (Hint: Top 5 descending order of count of the number of books the publisher has published)
- f. Answer the following Queries. Feel free to use any of the views that you created in part (e.):
1. For each employee class, list the employees belonging to that class.
 2. Find the names of employees who are also a silver member 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 publisher and the book title that is borrowed most at the library.
 5. Find names of books that have not been borrowed in the last 5 months.
 6. Find the total number of Class 1 books and number of Class 2 books borrowed till date.
 7. Find the Gold Member with most number of guests.
 8. Find the month and year with the maximum books borrowed.
 9. Find the names of members who borrowed the most popular books.
 10. List all the details of books issued after the most current employee was hired.
 11. List all the members that have enrolled into Gold membership within a month of being enrolled as Silver members.
 12. Find the total amount of late fee paid in each month, for the last 3 months.
 13. Find the name of members who have been a silver member for over 5 years.
 14. Find the names and number of books borrowed by the potential gold members in the last year.

Phase IV. Document the final term project report.

- a. Problem description (Copy it from Web site).
- b. Project questions (Answer 3 questions listed in the project, justify your solution).
- c. EER diagram with all assumptions (Solution for Phase II a).
- 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. All requested SQL statements (Solution for Phase III-c, e and f).
- f. Dependency diagram (Solution for Phase III-b).