

# CS 6360 Database Design Term Project

## 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 important modules: Person, Employee, Member, Books, Publishers, Authors and Payment.

A Person can be an Employee or a Member. Employee can also be a Member. Details of a person such as Person ID, Name (First, Middle, Last), Address, Gender, Date of Birth, and Phone number (one person can have more than one phone number) are recorded. **Employee must be at least 18 years old.** The Employee has Employee ID, which should have the format “E`XXXX`” where X is a number from 0 to 9 (Hint: you can use `regexp_like()` function). Note: “E000”, “E999” are all valid employee IDs, “E01” or “E0001” are invalid employee IDs.

Each member is issued a library card. The library card details such as card ID, date of issue, membership level (Silver or Gold) and other information are stored. The library sometimes may provide Promotions associate with library cards. Each Promotion includes a unique Promotion code, and its description.

**Employee can be one of three classes: Library Supervisors, Cataloging Managers or Receptionists.** The start date of employment is recorded. Receptionists must be trained by a Trainer, a Trainer can be Library Supervisor or a Cataloging Manager. **Each Trainer has a trainer certificate with unique certificate number.** The certificate issuing date is also recorded. A Trainer can train multiple Receptionists.

**Each member is classified as a Silver member or Gold member.** A Guest log is maintained for the Gold members, which stores information such as the Gold member’s library card ID, guest ID, guest name, guest address, and guest contact information. Guest IDs are temporary IDs that a person gets when they visit as a guest of a Gold member. Each guest ID is not unique in the whole system, and only unique among all guest of a Gold member.

Books details such as book ID, book title and other information are stored. **Books are classified as only 3 categories: Cate. 1, Cate. 2 and Cate. 3.** Each category has a description of what this category is about (e.g. topics, contents, types of the books in the category). Each Cataloging Manager is responsible for cataloging books. They can only catalog one category per day, but may catalog different categories on different days.

Person can make comments to the Books. The comments include comment time, rating score (can be 1,2,3,4,5), and comment main contents.

A publisher can publish more than one book, 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 (you can add assumptions) are stored. Author details such as author ID, author name and other information are stored. One book can have multiple authors and one author can write more than one book.

A receptionist maintains records of borrowing details. Borrowing details are stored containing information about the borrowed book, the date of issue and due date of return, the details about the person borrowing the book, details of the receptionist and payment detail. Borrowed details are stored only when a person borrows a book. Payment detail such as Payment ID, **payment method (cash, debit/credit card)**, payment time and amount are stored.

## Project Questions

1. Is the ability to model superclass/subclass relationships likely to be important in the Wonder 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 above environment? Please describe how your design would be changed to satisfy your additional rules?
3. Justify using a Relational DBMS like Oracle for this project (Successfully design a relational database system, please show all the implementation in 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 your tables to **third normal form**.
- 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. 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 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 publisher whose books are all have at least 4.0 average rating score.
  4. PotentialGoldMember - This view returns the name, phone number and ID of the people who are not Gold member but borrowed books in every month in the past year.
  5. Fast Trainer – This view returns details of trainers who trains receptionist within 1 week after the trainer issued a certificate.
- e. Show the SQL statements of the following Queries. Feel free to use any of the views that you created in part (d.):
  1. List the details of all the supervisors of the library hired in 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 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 name of members who have been a silver member for over 5 years.
  12. Find the names of the potential gold members and number of books they borrowed in the last year.
  13. List the employee who trained the most number of receptionists.

14. List the Cataloging Managers who cataloged all categories every week in 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).