

Project Proposal: [Library Management System]

Team Members: Salma Khalfallah(Problem Domain and Solution), Nachiket Pandit(Major Entity Types), Bhaskar Atmakuri(Project Goals & User Benefits), Sharvesh Palaniraj(Assumptions on Volume of Data), Promy Biswas(Tables and Relationships)

1. Problem Domain and Solution - Salma

Overview:

Our mini-world consists of an up-and-coming small town in the DFW metroplex that just built a new library to support the local community's growth. Our group has been tasked with creating a library management system in order to support the library and its staff/users. The management system will store information about the books, authors, and user profiles (staff and members).

Business Description & Rules:

- All the books in the library should be accessible to the users in the database as well as the amount of books available, the author, unique book number, as well as their location in the library (i.e. Children's section, YA, etc.)
- The books in the library should be managed by a staff user. The staff of the library should be able to record books into the system, edit profiles, keep track of books in the library, trace any late books back to member users, as well as other notifications.
- The books in the library should also be accessible to a member user. The users should be able to set up their own membership accounts, request a book, keep track of a book's availability, locate the book in the library, as well as set up a payment option for any late fees that occur.

2. Major Entity Types - Nachiket

The major entities will be: Book, Employee, Member, Loan, Hold, and Event.

1. Book

- Definition:** A physical or digital book that is in the library collection that can be borrowed by members of the library.
- Function:** This entity will track general information about the book such as title, author, genre as well as its availability.
- Relationships:**
 - A book can be loaned by members.

- ii. A book can have multiple holds.

2. Employee

- a. **Definition:** Represents all of the staff that work at the library
- b. **Function:** This entity will track all employee information such as name, role, pay. Employees will be responsible for managing books and their placement, transactions and helping out members.
- c. **Relationships:**
 - i. An employee handles multiple fines
 - ii. An employee manages multiple loans

3. Member

- a. **Definition:** A registered user of the library.
- b. **Function:** A member will be able to checkout, return, reserve books, and pay fines.
- c. **Relationships:**
 - i. A member can have multiple loans
 - ii. A member can have multiple fines
 - iii. A member can place multiple holds

4. Loan

- a. **Definition:** A record of book that is borrowed by a member
- b. **Function:** An entry will track who borrowed a specific book, and it contains a due date, return status, and potential fine.
- c. **Relationships**
 - i. A loan is related to one member and one book

5. Hold

- a. **Definition:** A reservation put on a book by a member
- b. **Function:** This will prevent a certain book from being borrowed by other members until the member who reserved it picks it up.
- c. **Relationships:**
 - i. A hold is placed by one member on one book

6. Event

- a. **Definition:** Gatherings set up by the library such as workshops
- b. **Function:** This will keep track of event information such as location, time, and topic to encourage community engagement.
- c. **Relationships:**
 - i. A member can attend multiple events
 - ii. An employee can manage supervise multiple events

7. Department

- a. **Definition:** Departments of the library subsetting the books by genre
- b. **Function:** This will keep track of the location of books throughout the library for easier access and travel of the library.
- c. **Relationships:**
 - i. An employee can work for one department
 - ii. A book can belong to one department

3. Assumptions on Tables and Relationships - Promy

Estimated Number of Tables: The database will require 7 tables.

1. **Book-** Store Informations about the books.
2. **Member-** Stores information about library members.
3. **Employee-** Stores information about the employees.
4. **Loan-** Keeps a track of book checkouts and due dates.
5. **Hold-** Manages book reservation.
6. **Event-** Stores information about the library events.
7. **Department-** Store information about book location

Key Relationships:

1. Book - Loan (One to Many)
2. Book - Hold (One to Many)
3. Member - Loan (One to Many)
4. Member - Hold (One to Many)
5. Employee - Transaction (One to Many)
6. Member - Event (Many to Many)
7. Employee - Event (One to Many)
8. Department - Employee (One to One)
9. Department - Book (One to One)

4. Assumptions on Volumes of Data - Sharvesh

1. Books and inventory

- The library contains an extensive assortment of books covering a wide range of genres and subjects.
- New titles are frequently added, whereas older or damaged ones are sometimes withdrawn from circulation.

2. Library Members and Borrowing Activity

- The library caters to a significant group of active members, such as students, researchers, and leisure readers.
- Every year, numerous new members sign up, whereas a portion of memberships lapses.
- Books are borrowed often during the year, with lending trends varying according to seasonal changes and specific events.

3. Library Staff and Functions

- A group of committed employees oversees daily tasks, such as checking out books, processing returns, and helping visitors.
- During a hectic day, librarians manage many transactions, maintaining efficient operations.

4. Late Returns and Penalties

- A significant portion of books is returned overdue, resulting in fines that help support library upkeep and services.
- The penalty amounts differ but stay fair to promote prompt submissions.

5. Digital and Online Engagements

- The online catalog of the library is extensively utilized, as members often look for books and make reservations.
- Digital services experience steady interaction, particularly for booking books and verifying availability

5. Project Goals and User Benefits - Bhaskar

Our library management system aims to streamline library operations by providing a structured and efficient way to manage books, users, and transactions. It will serve as a centralized database for both the staff and users to interact with the library's many resources.

Some of the goals for this project are:

- Efficient book management - track book availability, locations, and reservations
- Seamless user experience - allow members to check out, return, or reserve books
- Staff optimization - enable employees to manage books and transactions easily
- Data integrity and security - ensure all books and transaction records are safely stored and updated reliably
- Scalability : design the DB to handle increasing number of books, members, and transactions as the library grows

User Benefits:

- For library members:
 - Easier book search and reservation through online system
 - Easy view of book availability status
 - Automated notification for due dates and overdue books
- For library staff:
 - Streamlined check-in/check-out process for service speed
 - Efficient tracking and management of books and user accounts

- Reduced paperwork and administrative tasks
- Automated fine calculations and overdue tracking

6. Database Management System (DBMS) Selection

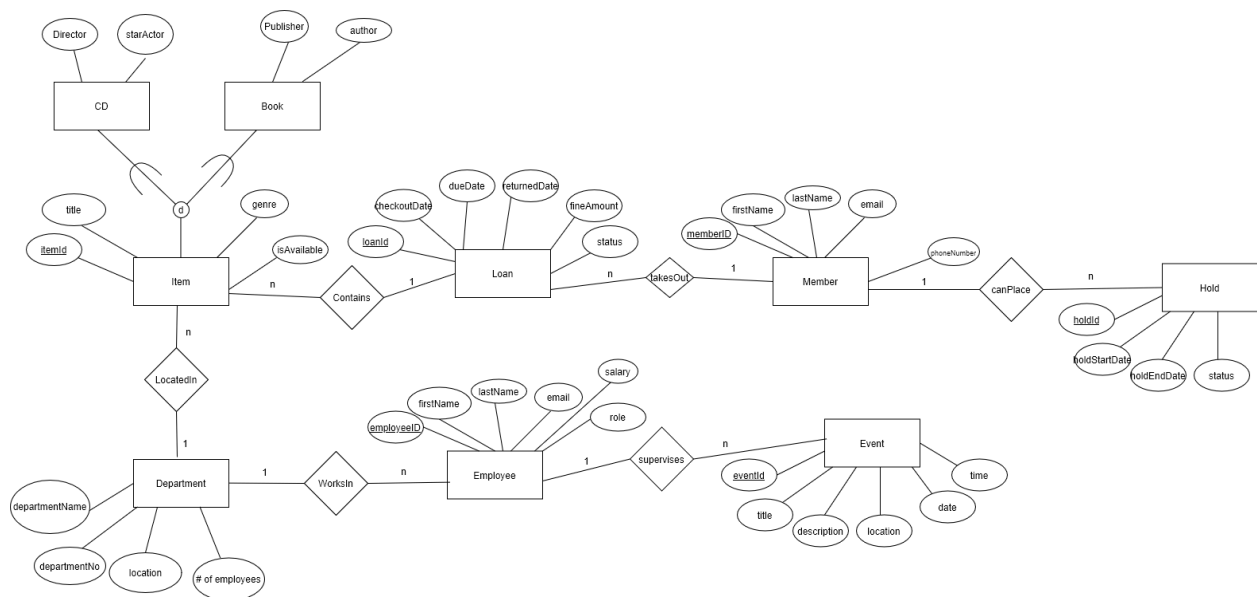
MySQL

Project Part 1: Data Model and Schema

Team Members: Salma Khalfallah, Nachiket Pandit, Bhaskar Atmakuri, Sharvesh Palaniraj, Promy Biswas

Note: Updates to proposal done by Salma

1. Entity-Relation Diagram (Nachiket)



Place image for ER Diagram here

Draw.io Link:

https://drive.google.com/file/d/1TsKL-xDM15UAvikF7Xc0IK3gZKiqHc_Z/view?usp=drive_link

Tool used for ER-Diagram: Draw.io

2. Supporting Schema Diagram (Nachiket)

Item

<u>itemID</u>	title	genre	isAvailable
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CD

<u>itemID</u>	director	starActor
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Book

<u>itemID</u>	publisher	author
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Loan

<u>loanID</u>	<u>itemID</u>	checkoutDate	dueDate	returnDate	status	fine
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Member

<u>memberID</u>	<u>loanID</u>	firstName	lastName	email	phoneNumber
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Hold

<u>holdID</u>	<u>memberID</u>	holdStartDate	holdEndDate	status
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Department

<u>departmenNo</u>	<u>itemID</u>	location	employeeCount	departmentName
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Employee

<u>employeeID</u>	<u>departmentID</u>	firstName	lastName	email	salary	role
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Event

<u>eventID</u>	<u>supervisorID</u>	title	description	location	date	time
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Draw.io link:

https://drive.google.com/file/d/1FmNb1SseBCL_O6-YhnkK1CQGeRBQ3zE8/view?usp=sharing

Tool used for Supporting Schema Diagram: Draw.io

3. Data Dictionary (Salma)

Table	Table Description	Primary Key	SuperKey	Attributes			Foreign Key
Item	An item that is available for check-out from the library.	ItemID	{ItemID, Title}				N/A
				Attribute	Data type	Domain	
				ItemID	INT(13)	Any integer	
				Title	VARCHAR	Any string	
				Genre	VARCHAR	Any string	
				isAvailable	BOOLEAN	{0,1}	
Book	Subclass of item, a book that can be checked out from the library	ItemID	{ItemID, Title, Author}				N/A
				Attribute	Data type	Domain	
				ItemID	INT(13)	Any integer	
				Publisher	VARCHAR	Any string	
				Author	VARCHAR	Any string	

CD	Subclasses of item, a CD that can be checked out from the library	ItemID	{ItemID, Title, Director}	<table><tr><td>Attribute</td><td>Data type</td><td>Domain</td></tr><tr><td>ItemID</td><td>INT(13)</td><td>Any integer</td></tr><tr><td>Director</td><td>VARCHAR</td><td>Any string</td></tr><tr><td>starActor</td><td>VARCHAR</td><td>Any string</td></tr></table>	Attribute	Data type	Domain	ItemID	INT(13)	Any integer	Director	VARCHAR	Any string	starActor	VARCHAR	Any string	N/A												
Attribute	Data type	Domain																											
ItemID	INT(13)	Any integer																											
Director	VARCHAR	Any string																											
starActor	VARCHAR	Any string																											
Employee	Staff working at the library	Employee ID	{FirstName, LastName, EmployeeID}	<table><tr><td>Attribute</td><td>Data type</td><td>Domain</td></tr><tr><td>EmployeeID</td><td>INT(6)</td><td>Any integer</td></tr><tr><td>DepartmentNo</td><td>INT(2)</td><td>Any integer</td></tr><tr><td>FirstName</td><td>VARCHAR</td><td>Any string</td></tr><tr><td>LastName</td><td>VARCHAR</td><td>Any string</td></tr><tr><td>Email</td><td>VARCHAR</td><td>Any string</td></tr><tr><td>Salary</td><td>INT</td><td>Any integer</td></tr><tr><td>Role</td><td>VARCHAR</td><td>Any string</td></tr></table>	Attribute	Data type	Domain	EmployeeID	INT(6)	Any integer	DepartmentNo	INT(2)	Any integer	FirstName	VARCHAR	Any string	LastName	VARCHAR	Any string	Email	VARCHAR	Any string	Salary	INT	Any integer	Role	VARCHAR	Any string	Department No
Attribute	Data type	Domain																											
EmployeeID	INT(6)	Any integer																											
DepartmentNo	INT(2)	Any integer																											
FirstName	VARCHAR	Any string																											
LastName	VARCHAR	Any string																											
Email	VARCHAR	Any string																											
Salary	INT	Any integer																											
Role	VARCHAR	Any string																											
Member	Registered user of library	MemberID	{FirstName, LastName, MemberID}	<table><tr><td>Attribute</td><td>Data type</td><td>Domain</td></tr><tr><td>Member</td><td>INT(6)</td><td>Any</td></tr></table>	Attribute	Data type	Domain	Member	INT(6)	Any	LoanID																		
Attribute	Data type	Domain																											
Member	INT(6)	Any																											

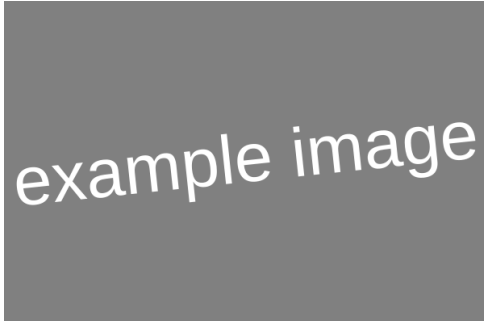
				<table><tr><td>ID</td><td></td><td>integer</td></tr><tr><td>LoanID</td><td>INT(10)</td><td>Any integer</td></tr><tr><td>FirstNa me</td><td>VARCH AR</td><td>Any string</td></tr><tr><td>LastNa me</td><td>VARCH AR</td><td>Any string</td></tr><tr><td>Email</td><td>VARCH AR</td><td>Any string</td></tr><tr><td>PhoneN umber</td><td>INT(9)</td><td>Any integer</td></tr></table>	ID		integer	LoanID	INT(10)	Any integer	FirstNa me	VARCH AR	Any string	LastNa me	VARCH AR	Any string	Email	VARCH AR	Any string	PhoneN umber	INT(9)	Any integer	
ID		integer																					
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LastNa me	VARCH AR	Any string																					
Email	VARCH AR	Any string																					
PhoneN umber	INT(9)	Any integer																					
Depart ment	A subdivisi on of the library in a specific subject	Dept_num	{Department No, Department Name}	<table><tr><td>Attribute</td><td>Data type</td><td>Domain</td></tr><tr><td>Departm entNo</td><td>INT(2)</td><td>Any integer</td></tr><tr><td>ItemID</td><td>INT(13)</td><td>Any integer</td></tr><tr><td>Location</td><td>VARCH AR</td><td>Any string</td></tr><tr><td>Employe eCount</td><td>INT(5)</td><td>Any integer</td></tr><tr><td>Departm entNam e</td><td>VARCH AR</td><td>Any string</td></tr></table>	Attribute	Data type	Domain	Departm entNo	INT(2)	Any integer	ItemID	INT(13)	Any integer	Location	VARCH AR	Any string	Employe eCount	INT(5)	Any integer	Departm entNam e	VARCH AR	Any string	ItemID
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Location	VARCH AR	Any string																					
Employe eCount	INT(5)	Any integer																					
Departm entNam e	VARCH AR	Any string																					
Events	Various events occurrin g in the library to support the	Event_num	{Event_num , Event_nam e, Event_man ager}	<table><tr><td>Attribute</td><td>Data type</td><td>Domain</td></tr><tr><td>EventID</td><td>INT(10)</td><td>Any string</td></tr></table>	Attribute	Data type	Domain	EventID	INT(10)	Any string	SupervisorI D												
Attribute	Data type	Domain																					
EventID	INT(10)	Any string																					

	library and its patrons			<table><tr><td></td><td></td><td></td></tr><tr><td>SupervisorID</td><td>INT(6)</td><td>Any integer</td></tr><tr><td>Title</td><td>VARCHAR</td><td>Any string</td></tr><tr><td>Description</td><td>VARCHAR</td><td>Any string</td></tr><tr><td>Location</td><td>VARCHAR</td><td>Any string</td></tr><tr><td>Date</td><td>INT(8)</td><td>Any integer</td></tr></table>				SupervisorID	INT(6)	Any integer	Title	VARCHAR	Any string	Description	VARCHAR	Any string	Location	VARCHAR	Any string	Date	INT(8)	Any integer							
SupervisorID	INT(6)	Any integer																											
Title	VARCHAR	Any string																											
Description	VARCHAR	Any string																											
Location	VARCHAR	Any string																											
Date	INT(8)	Any integer																											
Loan	A transaction between a member and the library borrowing an item	LoanID	{LoanID, ItemID}	<table><tr><td>Attribute</td><td>Data type</td><td>Domain</td></tr><tr><td>LoanID</td><td>INT(10)</td><td>Any integer</td></tr><tr><td>ItemID</td><td>INT(13)</td><td>Any integer</td></tr><tr><td>CheckoutDate</td><td>INT(8)</td><td>Any integer</td></tr><tr><td>DueDate</td><td>INT(8)</td><td>Any integer</td></tr><tr><td>ReturnDate</td><td>INT(8)</td><td>Any integer</td></tr><tr><td>Status</td><td>BOOLEAN</td><td>{0,1}</td></tr><tr><td>Fine</td><td>INT(4)</td><td>Any positive integer</td></tr></table>	Attribute	Data type	Domain	LoanID	INT(10)	Any integer	ItemID	INT(13)	Any integer	CheckoutDate	INT(8)	Any integer	DueDate	INT(8)	Any integer	ReturnDate	INT(8)	Any integer	Status	BOOLEAN	{0,1}	Fine	INT(4)	Any positive integer	ItemID
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Fine	INT(4)	Any positive integer																											

Project Part 2: Implementation, Data Generation

1. Implementation (Salma, Nachiket, Bhaskar)

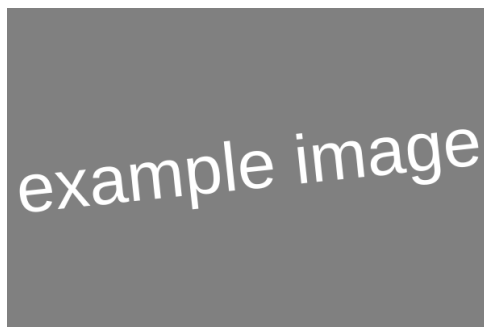
- Screenshot of database tool work area (area where commands are entered through SQL commands)



- Including an implementation log showcasing dates and time of creation of tables, columns, keys, and updates to database schema (include only SCHEMA changes)
- Example of implementation log below:

Update	Date	Time	Action done by	Notes
CREATE TABLE (ITEM)	04/20/2025	9:45PM	Salma Khalfallah	

- Specific screen shots of database executing SQL commands:
 - CREATE



- SELECT

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- INSERT

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- DELETE

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- UPDATE

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- DROP



2. Data Generation (Sharvesh, Promy)

- Populate database with meaningful data - data supporting business rules
 - Estimate number of rows/tuples for each table
 - Enter data using scripts, other code, or manually
- List showing each table and planned size considering the relationships (ex: how many librarians work at the library, how many books does the library have?)
- Example below:

Table	Planned size
EMPLOYEE	15

- List showing one row/tuple from each table with data:
- Example below for EMPLOYEE relation:

Employee ID	DepartmentID	FirstName	LastName	Email	Salary	Role
6449924	3	John	Doe	johndoe@gmail.com	\$2	Librarian

- Execute the following queries:
 - Show count of the largest population (i.e. how many books are in the library?)



- Show a listing of a key entity in the database (i.e. who are the librarians in the library?)

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- Show a list of entities that must function together (i.e. how many librarians work in a specific department?)

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- Show the cost of an occurrence, derived using aggregate functions (will be asking professor about this)

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- Show a schedule for multiple occurrences, sorted by date and time (i.e. when will certain events occur in the library?)

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