Part 4: Logical Relational Model

Project Overview

- Purpose
    - This database is designed to replace outdated, handwritten record-keeping systems for tracking library assets. By automating the process, librarians and staff can reduce the time spent on administrative tasks and focus more on assisting students. It also minimizes human errors, ensures accurate record-keeping, and improves overall efficiency in managing library materials.

- Intended Use
    - The database serves as an automated system for tracking library assets, making it easier to manage inventory, lending, and returns. It will be used by students, teachers, librarians, school administrators, and the IT department. Students will primarily use it to search the catalog, check out books, and track their borrowing history. Librarians and administrators will oversee inventory, manage book conditions, and handle late fees or lost book charges. By streamlining these processes, the database ensures smoother library operations and better access to educational resources.

Project Scope

The School Library Database will serve as a centralized system for efficiently managing library resources, user accounts, and borrowing activities. The system will track books, their availability, and condition while maintaining comprehensive borrowing records. It will support core library functions such as inventory management, book reservations, loan processing, and overdue fee calculations. The database will also enable librarians and administrators to monitor user activity, enforce borrowing policies. The Relationship Schema will define key entities, relationships, and constraints, providing a structured, tabular representation of how data is organized and interconnected within the system. This ensures seamless operations while maintaining scalability and accuracy in tracking library assets and user interactions.

Glossary

- **ISBN:** (International Standard Book Number) is a unique identifier assigned to books for tracking and cataloging purposes.
- **Medium:** The format in which a library item is available, such as DVD, VHS, Blu-ray, audiobook, eBook, or print.
- **Unix Timestamp:** A numerical representation of time, counting the number of seconds that have elapsed since January 1, 1970 (UTC). It is commonly used in databases and programming for date/time storage and calculations.
- **VARCHAR:** (Variable Character) A data type in SQL that stores variable-length text strings. It allows storing strings with a defined maximum length, making it more efficient than fixed-length types like char.

Relational Schema Mapping

Relations

- items
- books
- digital_media
- magazines
- authors
- users
- students
- faculty
- fees
- reserves
- loan

Attributes & Domains

- item_id
- author_id
- isbn
- genre
- publisher_name
- edition
- publication_date
- faculty_only
- first_name
- middle_name
- last_name
- medium
- publication_date
- issue_number
- title
- price
- condition
- reserve_id
- user_id
- reserve_time
- loan_id
- checkout_time
- expected_time
- email
- address
- phone
- role
- amount
- fee_applier
- fee_acceptor
- reason

- status

Primary Keys

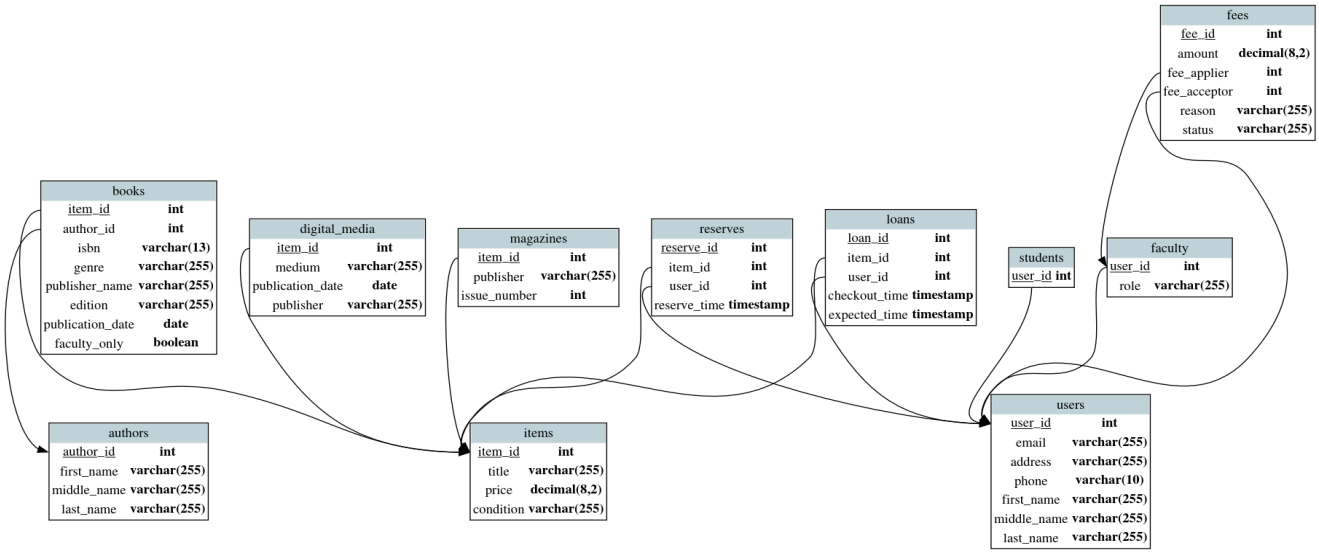
- item_id (items, books, digital_media, magazines)
- author_id (authors)
- user_id (users, students, faculty)
- fee_id (fees)
- reserve_id (reserve)
- loan_id (loan)

Foreign Keys

- item_id (books, digital_media, magazines, reserve, loan)
- author_id (items)
- user_id (students, faculty, reserve, loan, fee)

Functional Dependencies (FDs)

- **Books**
  - **TBD**
- **Authors**
  - **TBD**
- **Digital Media**
  - **TBD**
- **Magazines**
  - **TBD**
- **Items**
  - **TBD**
- **Users**
  - **TBD**
- **Students**
  - **TBD**
- **Faculty**
  - **TBD**
- **Reserves**
  - **TBD**
- **Loans**
  - **TBD**
- **Fees**
  - **TBD**



Data Dictionary

Relations

Relation Name	Description	Attributes
items	This is a list of all items. An item may have an entry in books, digital_media, or magazines based on its type.	item_id, title,price,condition
books	If an item is a book, it will have an entry in book with the same item_id. This relation stores book specific info.	item_id, author_id, isbn, genre, publisher_name, edition, publication_date, faculty_only
digital_media	If an item is digital media, it will have an entry in digital_media with the same item_id. This relation stores digital media specific info.	item_id, medium, publication_date,publisher
magazines	If an item is a magazine, it will have an entry in magazines with the same item_id. This relation stores magazine specific info.	item_id,publisher,issue_number
authors	This relation associates an author_id with a full name consisting of a first name, middle name, and last name	author_id,first_name,middle_name,last_name
users	This is a list of all users. A user may have an entry in students or faculty if they are either a student or faculty member.	user_id,email,address,phone,first_name,middle_name,last_name

students	If a user is a student, it will have an entry in student with the same user_id. This relation only serves to identify if a user is a student.	user_id
faculty	If a user is a faculty member, it will have an entry in faculty with the same user_id. This contains role specific information for the given faculty member	user_id,role
fees	Contains fees applied to specific users and whether or not they have been paid.	fee_id,amount,fee_applier,fee_acceptor,reason,status
reserves	Is a relation that shows which users have reserved specific books. The earliest user to reserve a book is the next person to get that book. After the book has been turned in, it is lent out to the next reservee.	reserve_id,item_id,user_id,reserve_time
loan	Is a relation that show which items are currently out for loan. Entries get deleted once they are no longer loaned out.	loan_id,item_id,user_id,checkout_time,expected_time

Attributes

Attribute	**Datatype**	**Domain**	**Description**
item_id	INT	Any value >= 0 is valid	A unique identifier for each item in the library
title	VARCHAR(255)	Title can be anything that doesn't contain null characters	The title of the item
price	DECIMAL(8,2)	Price can be any non negative value	The price of the item
condition	VARCHAR(255)	Condition should be either "new", "good", or "bad"	The condition of the item
publisher_name	VARCHAR(255)	Name can be anything that doesn't contain null characters	The publisher that published the item
publication_date	DATE	Date can be any valid date	The date the item was published
author_id	INT	Any value >= 0 is valid	The author of the book

isbn	VARCHAR(13)	The length must be either 10 or 13 in length. In addition, it must only be digits	International Standard Book Number, unique to each edition and variation of a book
genre	VARCHAR(255)	Genre can be “action”, “adventure”, “comedy”, “drama”, “fantasy”, “horror”, “mystery”, “romance”, “scifi”, “thriller”, or “other”	The genre of the book
edition	VARCHAR(255)	Can be any valid string without null characters representing the edition	The edition of the book
faculty_only	BOOLEAN	Can either be true or false	Determines whether the book is only able to be loaned to a faculty member
medium	VARCHAR(255)	Medium can be “ebook”, “audiobook”, “dvd”, “vhs”, “bluray” or “scanned”	The format of the digital media (e.g., eBook, Audiobook, DVD, VHS, Blu-ray, print, etc.).
issue_number	INT	Can be any number >= 1	The issue number of the magazine
first_name	VARCHAR(255)	Must contain no spaces or non alphabetic characters	The author’s first name
middle_name	VARCHAR(255)	Must contain no spaces or non alphabetic characters	The author’s middle name
last_name	VARCHAR(255)	Must contain no spaces or non alphabetic characters	The author’s last name
user_id	INT	Can be any number >= 0	A unique identifier for each user
email	VARCHAR(255)	Must be a valid email address	The user’s email address
address	VARCHAR(255)	Must be a valid physical address	The user’s address
phone	VARCHAR(10)	Can only be digits representing a US phone number	The user’s phone number

role	VARCHAR(255)	Can be “teacher”, “librarian”, “admin”, or “it”	The faculty member’s role (Teacher, Librarian, Administrator, IT)
fee_id	INT	Can be any number >= 0	A unique identifier for each fee
amount	DECIMAL(8,2)	Can be any non negative value	The amount of the fee
fee_applier	INT	Must correlate with an existing faculty user id	The ID of the faculty who assigned the fee
fee_acceptor	INT	Must correlate with an existing user id	The ID of the user who got assigned the fee
reason	VARCHAR(255)	This can be any valid string without null characters describing why a fee was applied	The reason for the fee (e.g., Overdue book, Lost item, Damage fee)
status	VARCHAR(255)	Can be “paid”, “unpaid”, or “waived”	The status of the fee payment (Paid, Unpaid, Waived)
reserve_id	INT	Can be any number >= 0	A unique identifier for each reservation
reserve_time	TIMESTAMP	Bounded by the limits of timestamp	The timestamp of when the user reserved the item
loan_id	INT	Can be any number >= 0	A unique identifier for each loan
checkout_time	TIMESTAMP	Bounded by the limits of timestamp	The timestamp of when the item was checked out
expected_time	TIMESTAMP	Lower bound must be greater than checkout time. Higher bound only bounded by timestamp limit.	The timestamp of the expected return