CSE 3330 Database System & File Structures

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Project 2 library DB Part 1

Group 13, Section 004

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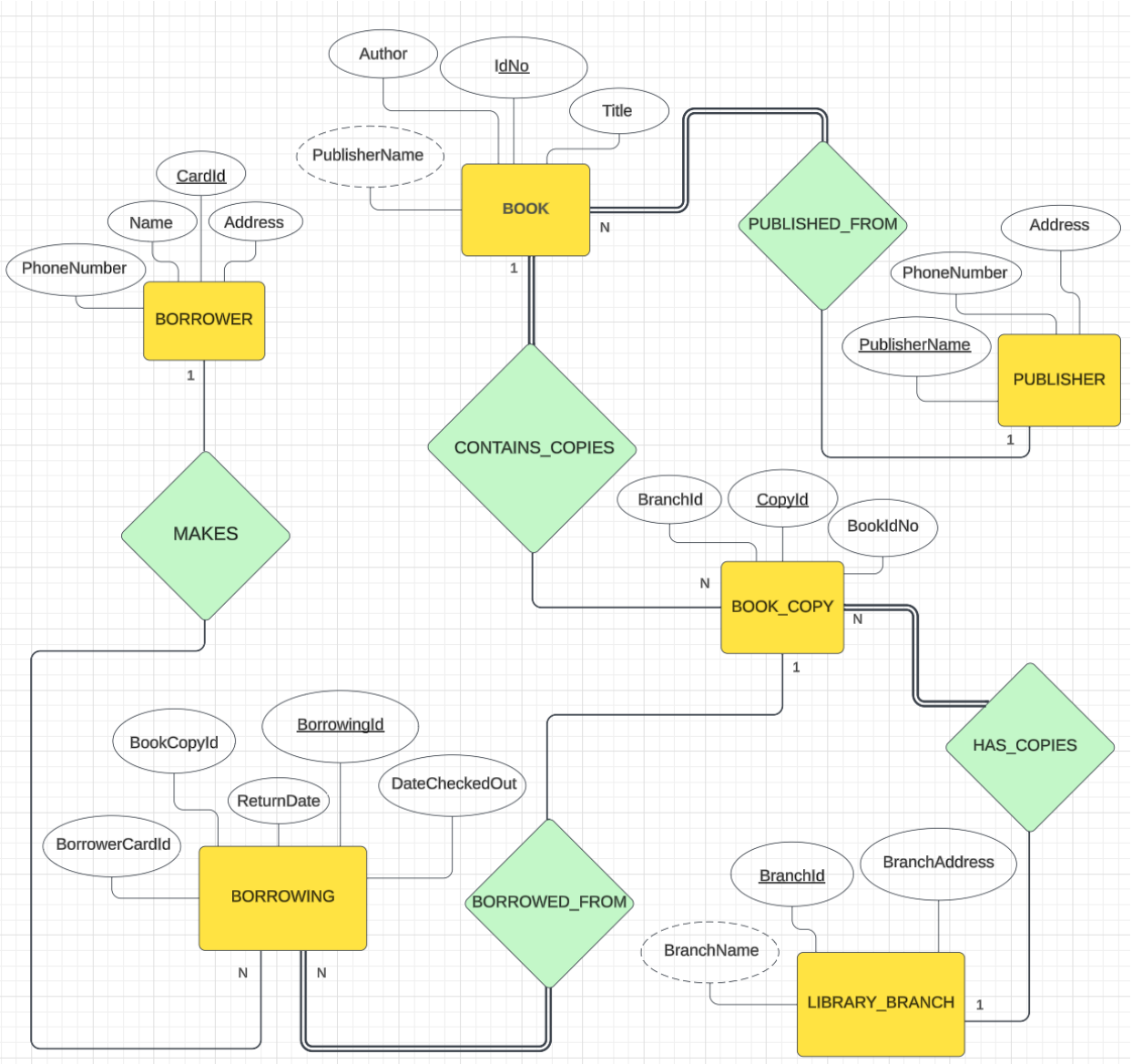
INTRODUCTION

This document presents the design and development of a database for a Library Management System. The objective is to create an efficient system for tracking library resources, branches, and borrowing transactions.

MINI-WORLD DESCRIPTION

ER DIAGRAM:



ENTITIES AND ATTRIBUTES:

1. BOOK
    - IdNo (PK, integer)
    - Title (string)
    - Author (string)
    - PublisherName (FK from LIBRARY_BRANCH)

2. PUBLISHER
    - PublisherName (PK, string)
    - PhoneNumber (string)
    - Address (string)

3. LIBRARY_BRANCH
    - BranchId (PK, integer)
    - BranchName (string)
    - BranchAddress (string)

4. BOOK_COPY
    - CopyId (PK, integer)
    - BookIdNo (FK from BOOK)
    - BranchId (FK from LIBRARY_BRANCH)

5. BORROWER
    - CardId (PK, integer)
    - Name (string)
    - Address (string)
    - PhoneNumber (string)

6. BORROWING
    - BorrowingId (PK, integer)
    - BookCopyId (FK from BOOK_COPY)

- BorrowerCardId (FK from BORROWER)
- DateCheckedOut (date)
- ReturnDate (date, NULL if not returned)

MISSING OR INCOMPLETE REQUIREMENTS:

- Borrowing Limits:
  - In real life systems, there are usually limits in place for borrowing. A borrower cannot usually borrow more than N times (say 3 books at once).

- Due Dates and Penalties:
  - There is ambiguity surrounding what happens if a book is returned late. The requirements talk about borrowing and return dates but not regarding due dates and penalties.

- Multiple Authors:
  - In the ER diagram for the library management system, each book only has a single Author attribute; however, in real life, there can be multiple authors for a single book. A suggestion would be to use a many-to-many relationship between BOOK and AUTHOR. This will require an additional AUTHOR entity.

- Publisher Contact Details:
  - For PUBLISHER, the current design does not give ample contact information (PublisherName, PhoneNumber, and Address). An email would be beneficial for contacting a PUBLISHER.

- Book Genres or Categories:
  - In the ER diagram for the library management system, there is no way to specify the genre or category of books. Libraries often need to categorize books, so a new entity such as CATEGORY or GENRE would be beneficial.

- Library Employees:
    - There is currently no way for someone to manipulate the library system as a staff worker. There needs to be someone who handles borrowing, checking in/out, returns, or etc work that a librarian does. An EMPLOYEE entity would be beneficial.

- Book Condition:
    - There's currently no mention of the condition of book copies in a given library branch (e.g., New, Good, Damaged, etc.). This is crucial for tracking which books need maintenance (repairs, rebinding, tears, etc). A Condition attribute in BOOK_COPY could be beneficial.

ASSUMPTIONS:

- Unique Book Identification:
    - The system assumes each book is uniquely identified by an IdNo. Even if multiple copies of the same book exist, they are tracked separately as BOOK_COPY instances, each with a unique CopyId.

- Publishers are Predefined:
    - It is assumed that PUBLISHER records are predefined in the system. If new books are added, they must be linked to an existing PUBLISHER.

- Single Branch for Each Book Copy:
    - Each BOOK_COPY exists in only one LIBRARY_BRANCH at a time. There's no inter-branch transfer of books or sharing in the current design.

- Every Book is Published:
    - We assume every BOOK has a publisher. There's no need for books without publishers (e.g., self-published works) in this design.

- Return of Books:

    - The system assumes that borrowers always return books. No explicit mechanism is mentioned for permanently lost or unreturned books. If needed, you might track lost books separately.

- One-to-Many for Book to Copies:
    - The assumption is made that each BOOK will have multiple BOOK_COPIES, and at least one BOOK_COPY will exist for each book in the system.

- No Limit on Borrowing Time:
    - The system does not specify a maximum borrowing time, so it's assumed that ReturnDate can be set freely by the library without time restrictions.

EXPLANATION OF DESIGN CHOICES:

ENTITY CHOICES-

- BOOK: Represents each unique book with attributes like IdNo, Title, Author, and PublisherName to manage book-level details independently of copies.

- PUBLISHER: Stores publisher information (e.g., PublisherName, PhoneNumber, Address) for communication purposes.

- LIBRARY_BRANCH: Tracks branches by BranchId, BranchName, and BranchAddress, supporting multiple locations.

- BOOK_COPY: Represents individual copies of books, with CopyId, BranchId, and BookIdNo linking to the main BOOK entity.

- BORROWER: Identifies library users with CardId, Name, Address, and PhoneNumber.

- BORROWING: Records each transaction, including BorrowingId, BookCopyId, BorrowerCardId, DateCheckedOut, and ReturnDate to track borrowing history.

RELATIONSHIP CHOICES-

- CONTAINS_COPIES (BOOK to BOOK_COPY):
  - Type: One-to-Many. Each book can have multiple copies.
  - Total participation on BOOK side, ensuring every book has at least one copy.

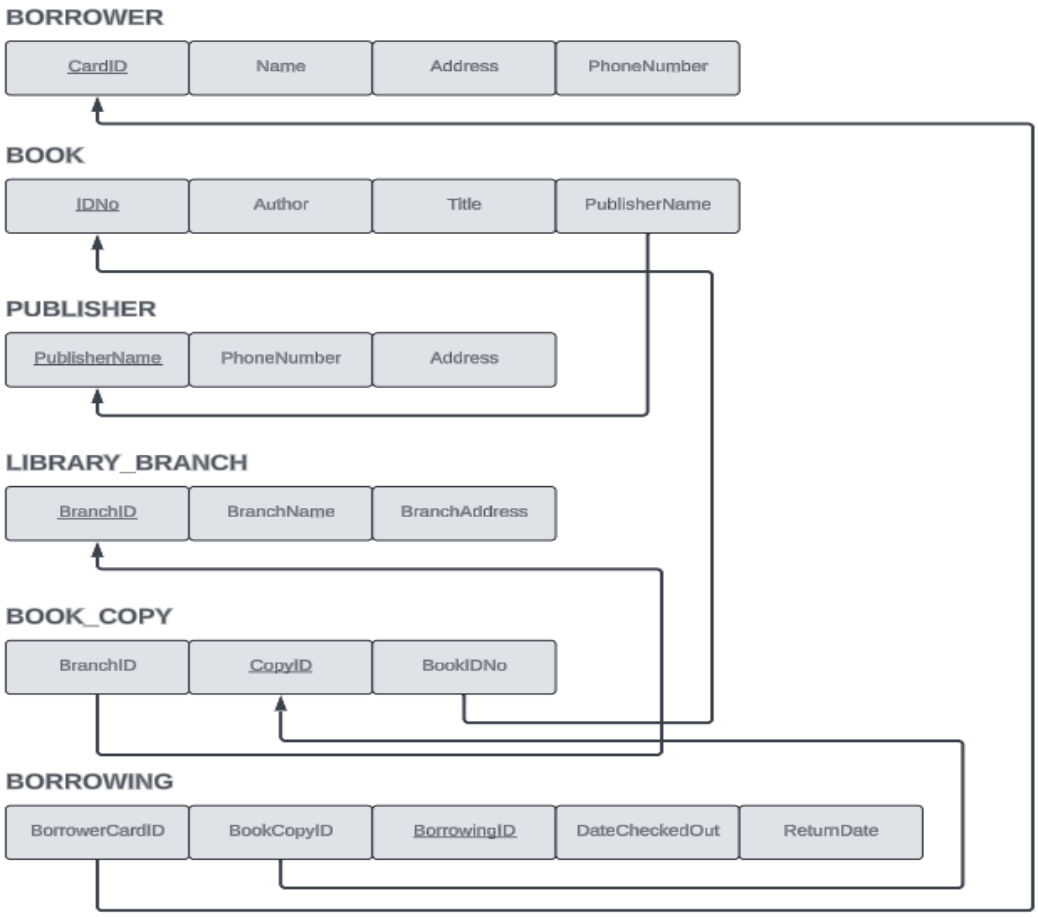
- PUBLISHED_FROM (BOOK to PUBLISHER):
  - Type: Many-to-One. Each book is published by one publisher, while a publisher can publish many books.
  - Total participation on BOOK side, as every book must have a publisher.

- HAS_COPIES (BOOK_COPY to LIBRARY_BRANCH):
  - Type: Many-to-One. Each book copy belongs to a specific branch.
  - Total participation on BOOK_COPY side, as every copy must be located in a branch.

- BORROWED_FROM (BOOK_COPY to BORROWING):
  - Type: One-to-Many. Each BOOK_COPY can be borrowed multiple times, tracking each borrowing instance.
  - Participation: Partial on BOOK_COPY side (not all copies are borrowed); Total on BORROWING side (each borrowing must link to a copy).

- MAKES (BORROWER to BORROWING):
  - Type: One-to-Many. A borrower can make multiple borrowing transactions.
  - Partial participation on BORROWER side, as not every borrower needs to borrow books.

RELATIONAL DATABASE SCHEMA



EXPLANATION OF DESIGN CHOICES:

Primary keys

- CardID(Borrower): To identify each individual separately.
- IDNo(Book): Each book will have a unique ID to separate books with the same titles.
- PublisherName(Publisher): Each publisher has a unique name.
- BranchID(Library_branch): To identify branches of the same name or address.
- CopyID(Book_copy): Book copies have their own ID separate to BookID for other branches.
- BorrowingID(Borrowing): A separate ID to check a specific borrowing of a book.

Foreign Keys

- PublisherName(Book): A single publisher can have many books.
- BranchID(Book_copy): Branches can hold many books.
- BookIDNo(Book_copy): There's one copy ID for each branch, so the same ID can show up again at a different branch.
- BookCopyID(Borrowing): Can identify what branch the borrowing took place.
- BorrowerCardID(Borrowing): To identify who's borrowing a book. They may borrow multiple.

CONTRIBUTION LIST

Shaheen Nijamudheen - ER diagram
James Paul Nguyen - Relational database schema
Ali Shirazi-Nejad - ER diagram, missing and incomplete requirements

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