DATA MANAGEMENT PROJECT

LIBRARY MANAGEMENT SYSTEM

GROUP 1

TEAM MEMBERS:

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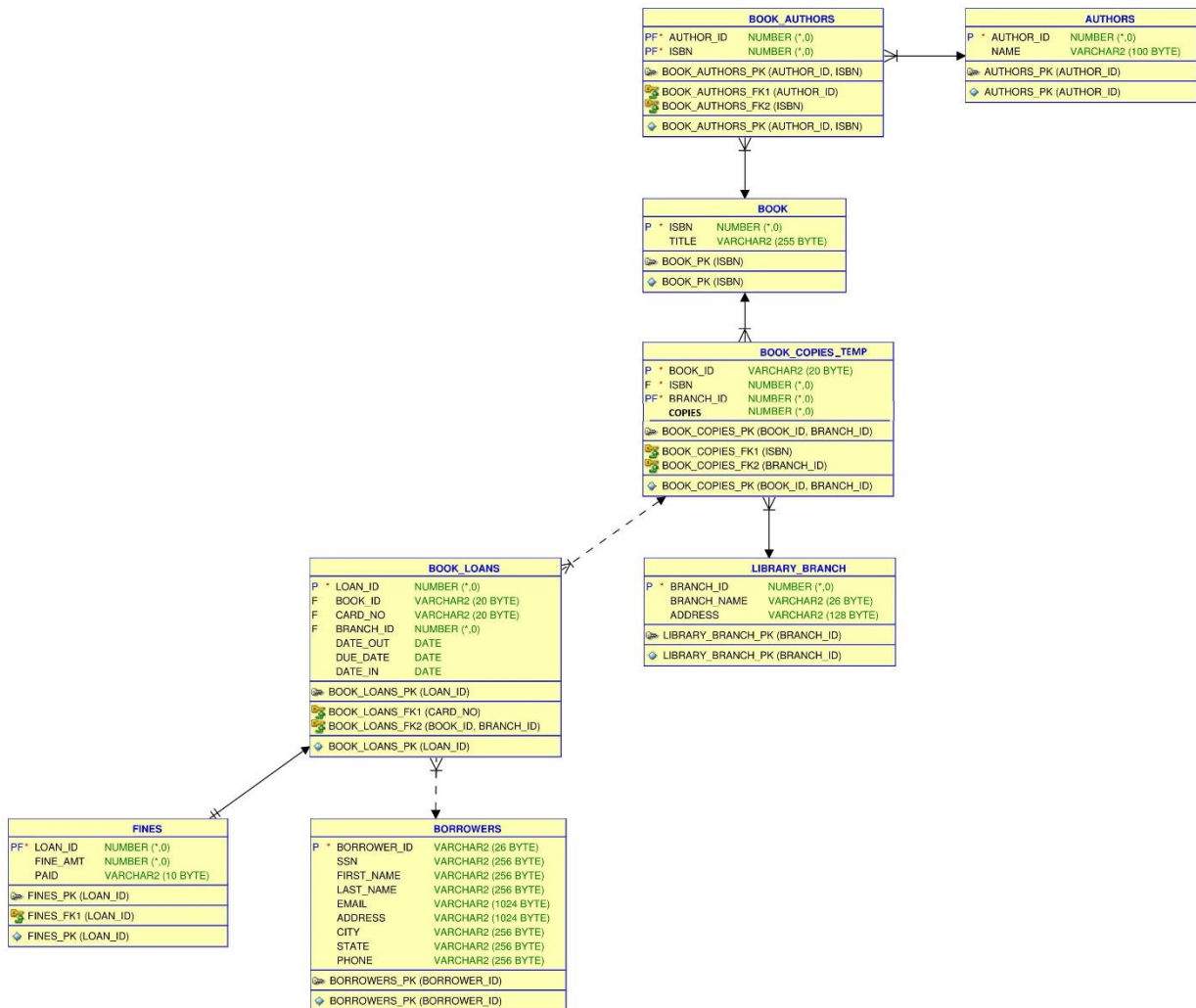**Ronit Kadam (RRK170330)**

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Contents

DESIGN DOCUMENT

Entity-Relationship Diagram for the Library Management System:

BOOK_AUTHORS

PF*	AUTHOR_ID	NUMBER (*,0)
PF*	ISBN	NUMBER (*,0)

- BOOK_AUTHORS_PK (AUTHOR_ID, ISBN)
- BOOK_AUTHORS_FK1 (AUTHOR_ID)
- BOOK_AUTHORS_FK2 (ISBN)
- BOOK_AUTHORS_PK (AUTHOR_ID, ISBN)

AUTHORS

P	* AUTHOR_ID	NUMBER (*,0)
	NAME	VARCHAR2 (100 BYTE)

- AUTHORS_PK (AUTHOR_ID)
- AUTHORS_PK (AUTHOR_ID)

BOOK

P	* ISBN	NUMBER (*,0)
	TITLE	VARCHAR2 (255 BYTE)

- BOOK_PK (ISBN)
- BOOK_PK (ISBN)

BOOK_COPIES_TEMP

P	* BOOK_ID	VARCHAR2 (20 BYTE)
F	* ISBN	NUMBER (*,0)
PF*	BRANCH_ID	NUMBER (*,0)
	COPIES	NUMBER (*,0)

- BOOK_COPIES_PK (BOOK_ID, BRANCH_ID)
- BOOK_COPIES_FK1 (ISBN)
- BOOK_COPIES_FK2 (BRANCH_ID)
- BOOK_COPIES_PK (BOOK_ID, BRANCH_ID)

BOOK_LOANS

P	* LOAN_ID	NUMBER (*,0)
F	BOOK_ID	VARCHAR2 (20 BYTE)
F	CARD_NO	VARCHAR2 (20 BYTE)
F	BRANCH_ID	NUMBER (*,0)
	DATE_OUT	DATE
	DUE_DATE	DATE
	DATE_IN	DATE

- BOOK_LOANS_PK (LOAN_ID)
- BOOK_LOANS_FK1 (CARD_NO)
- BOOK_LOANS_FK2 (BOOK_ID, BRANCH_ID)
- BOOK_LOANS_PK (LOAN_ID)

LIBRARY_BRANCH

P	* BRANCH_ID	NUMBER (*,0)
	BRANCH_NAME	VARCHAR2 (26 BYTE)
	ADDRESS	VARCHAR2 (128 BYTE)

- LIBRARY_BRANCH_PK (BRANCH_ID)
- LIBRARY_BRANCH_PK (BRANCH_ID)

FINES

PF*	LOAN_ID	NUMBER (*,0)
	FINE_AMT	NUMBER (*,0)
	PAID	VARCHAR2 (10 BYTE)

- FINES_PK (LOAN_ID)
- FINES_FK1 (LOAN_ID)
- FINES_PK (LOAN_ID)

BORROWERS

P	* BORROWER_ID	VARCHAR2 (26 BYTE)
	SSN	VARCHAR2 (256 BYTE)
	FIRST_NAME	VARCHAR2 (256 BYTE)
	LAST_NAME	VARCHAR2 (256 BYTE)
	EMAIL	VARCHAR2 (1024 BYTE)
	ADDRESS	VARCHAR2 (1024 BYTE)
	CITY	VARCHAR2 (256 BYTE)
	STATE	VARCHAR2 (256 BYTE)
	PHONE	VARCHAR2 (256 BYTE)

- BORROWERS_PK (BORROWER_ID)
- BORROWERS_PK (BORROWER_ID)

DESIGN DECISION

Our system consists of a total of 9 tables.

1. **BOOK** is the main table all book related information
2. **AUTHORS** is main table author details
3. **BOOK_AUTHORS** have been added to remove N-N relationship between **BOOK** and **AUTHORS**
4. **LIBRARY_BRANCH** is the main library table
5. **BOOK_COPIES_TEMP** is the main table for number of book copies in a branch
6. **BORROWERS** is the table for library member information
7. **BOOK_LOANS** is the table that stores all the loan data
8. **FINES** table keeps track of the fines
9. **FINES_DATA** table is a placeholder table used to enhance the fine/penalty functionality

Each of table are assigned with respective keys and constraints to maintain the integrity of the system.

Three sequence generators are used to generate a unique primary key for **AUTHORS** (AUTHOR_ID), **BORROWERS** (BORROWER_ID) and **BOOK_LOANS** (LOAN_ID) table, every time there is a new entry in these tables.

Various validation checks are used all over the application in the form of PL/SQL validation code. These checks are used to validate data before inserting into the database. Book ID, ISBN, SSN, Date, existing fines and number of loans all are validated using checks. In case of any disparity appropriate errors are been displayed.

Initial Loading and Raw Data Manipulation

Initial loading and data cleaning was done using SQL Developer. The data was normalized and reformatted when and where required.

Data Flow in the Library System

Search → AUTHOR+BOOK+BOOK_COPIES_TEMP

Add Book → BOOK_COPIES_TEMP+AUTHOR+ BOOK+BOOK_AUTHORS

Registration → BORROWERS

Check out → BOOK_LOANS+ BOOK_COPIES_TEMP

Loans & Returns → BOOK_LOANS+BOOK_COPIES_TEMP+ FINES+FINES_DATA

Fines → FINES+FINES_DATA

Book Addition

Whenever this functionality is used, there are 3 possibilities. When only the number of copies is to be updated a procedure is made to update BOOK_COPIES_TEMP table. When a new book of a new author is to be added BOOK_COPIES_TEMP+AUTHOR+ BOOK+BOOK_AUTHORS all are updated. Similarly, when a new book from an existing author is to be added all tables except the AUTHORS table gets updated. These all tasks are done using a combination of checks and DML queries.

Member Registration

The process of registering a new member into the system uses only check to validate the SSN format and duplicity.

Book check out

Book check out involves the most number of checks and updates. There is a check for number of loans already present, one check for validating any pending fine and another check to see whether the requested book is available or not. If all the checks are successfully validated, then BOOK_LOANS and BOOK_COPIES_TEMP gets updated. There is a separate procedure to handle the dates involved in the check-out process. This process is completely automated and does not require any input from the user.

Returns

Book return process is like the check-out process. A date check validates the check-in date with check-out date. If successful, a total of 4 tables (BOOK_LOANS+BOOK_COPIES_TEMP+ FINES+FINES_DATA) gets updated. These all are done using similar procedures and triggers.

Fines

Fines is calculated on daily basis ($0.25/day). If fines are not duly cleared the system will not allow more check-outs. Only once fines are cleared the check-out for that member gets activated. This process involves 2 tables (FINES+FINES_DATA)

ARCHITECTURAL DESIGN

This Library Application includes all the functionalities that would be required for the functioning of any library. This can be explained by different steps as below

1. **Book Search and Availability:**
   To know the availability of book and in which branch it is available.

2. **Addition of New Books:**
   To add new books with new or existing authors in our system or to just update new copies.

3. **Adding/Registering Member:**
   If member is not available in the systems record. He can be added in the system by providing all the information asked for. A random and unique ID will be generated automatically after the member creation that can be obtained from the **Members** tab. Existing members details can also be checked in the **Members** tab by providing any of borrower details used to previously register with the system.

4. **Check-out:**
   Each member can borrow a maximum of 3 books. The system will not allow members to borrow more than 3 books. The date of borrow and due date to return the books are automatically generated. Date of borrow is the current date and due date is 14 days from the date of borrow. A fine/penalty of $0.25 will be added per book per day to the member if he/she fails to return the book on or before the due date. Members with outstanding fines will also not be allowed to loan additional books until cleared.

5. **Returns:**
   The members can return the borrowed books. The date of return is not automatically populated here for DEMO purpose and can be set to current date as in case of check-out whenever required. If the member returns book after due date, fine/penalty will be levied on the member. As mentioned above, the member will not be allowed to loan books unless and until this fine is cleared.

6. **Fine payment:**
   For members who return books after due date must pay a fine of 0.25 USD/day. Fine payment can be done by simply editing the payment status against their respective IDs. Once the member has paid their fine it will be reflected in the system and the members will be again eligible to check-out/borrow books.

7. **Reports:**
   Multiple reports are also present on the home page for better interactivity.
   a) Top Fine Due Report – Gives the top 10 defaulters for the library
   b) Monthly Report – Provides the month-wise loan from the library
   c) Fines per Loan ID – Similar to top fines but gives fines based on loan ID
   d) Popular Book Report - Gives the top 10 books borrowed from the library