In creating a library management system, we ensured the database model conforms with Third Normal Form (3NF) requirements. To confirm that the schema was in First Normal Form (1NF), we first checked that each attribute had an atomic value, meaning that no attribute contained more than one repeating group or array. Each table in the design—Member, Book, and Loan, for instance—has a distinct primary key (Member_ID, Book_ID, and Loan_ID, respectively) to ensure that each entry is uniquely recognizable. This structure guarantees the full normalization of the database to 1NF.

The design's compliance with Second Normal Form (2NF) was then confirmed. Since every non-key attribute in every table depends entirely on the complete primary key to function, there are no partial dependencies. For example, properties in the Loan table such as Checkout_Date, Due_Date, and Book_ID depend entirely, not only partially, on Loan_ID serving as the primary key. Our design is in 2NF since every non-key characteristic in the schema complies with full functional dependency.

Finally, we confirmed that the database meets the requirements of Third Normal Form (3NF) by eliminating transitive dependencies. In each table, non-key attributes depend solely on the primary key and not on any other non-key attribute. For instance, in the Book table, attributes such as Title, Author, and ISBN directly depend on Book_ID, the primary key, with no dependency on other non-key attributes. Initially, we had included Member_ID as a foreign key in the Book table, but we realized that this relationship was unnecessary because books should not be directly associated with a member—they are instead related to loans and reservations. By removing Member_ID which was a foreign key in the Book table, we eliminated an unnecessary dependency, which simplified the design and further assured compliance with 3NF. By ensuring that each non-key feature solely depends on the primary key of the related table, this update contributes to the complete normalization of the database, improving data integrity, and eliminating redundancy.

Member

PK	Member_ID
	name
	contact_Info
	Book_limit
	Lend_limit
	Membership_Status

Loan

PK	loan_ID
FK	Member_ID
FK	Book_ID
	Checkout_Date
	Due_Date
	Return_Date
	Status
	Renewal_Count

Payment

PK	Payment_ID
FK	Fine_ID
FK	Member_ID
	Amount

Book

PK	Book_ID
FK	Member_ID
	Title
	Author
	Genre
	ISBN
	publication_Year
	availibility_Status
	Renewal_Allowed

Fine

PK	Fine_ID
FK	loan_ID
	Amount
	Fine_Date
	Paid_Status

Reservation

PK	Reservation_ID
FK	Member_ID
FK	Book_ID
	Status
	Reservation_Order
	Reservation_Date
	Expiration_Date

(1,N)

(1,N)

(1,N)

(1,N)

(1,N)

(1,N)

(1,N)

(1,N)

(1,1)