



**Faculty of Computers &
Informatics**



Zagazig University

LIBRARY Database Project

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in partial fulfillment of the requirements for passing
the 2nd semester 2020 evaluation*

In

Relational Database

by

Hassan Ramadan Ibrahim Abdellatif (2123)

Supervised by

Dr. Nabil Moustafa

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1. Introduction

Database is the system that stores information to provide us speed access and a more powerful way to structure our data. Database came as an alternative technology for file systems which has a lot of problems database can solve them. This is a database-based project for a library management system that enables us to store information in an efficient way. So, databases improved data security, facilitate data access, and make the process of development new programs easy, efficient and structured. On the other hand, databases become complex and time-consuming to design. So, whether the database damaged, all applications based on it will be also be damaged. It's not easy also to convert file system to database and vise versa.

2. Content

Any library is a collection of information and references that is organized and structured in sections. This makes the library is a so beneficial resource to borrow a book, CD, film, newspaper, or any other type of information in digital of physical structure.

The LIBRARY system aims to convert the manual base operation to digital base, store all information about the library, and make it easy to maintain any piece of information about anything in the library. This is also an optimal solution to give customers access to the library's information whatever and whenever they want. This makes the business more flexible and easy to modified.

This automated system allows the librarian to store all information about books like their name, cost, and the number of them available in the library also other information. As it keeps track of all this information the customer and the user will find it very easy to make an effect on the application. The data is stored safely So, It will also provide more security to our system because the user of the database will determine who can access the x object.

Regardless of all of these advantages, the main advantage is the speed of access information any piece of information, and the easy way to support all operations based on this process like making a report that tracks imports and exports in a span of time.

LIBRARY database system structure:

A general library consists of a number of branches, Each branch has a specific address, unique id number and manger who can manage more than one branch.

The system can record details about employees, Each employee has name, position, salary, and unique id number. Also, employee can update books, manage branches, and differ in job type, there are manager, librarian, secretary ... et certra.

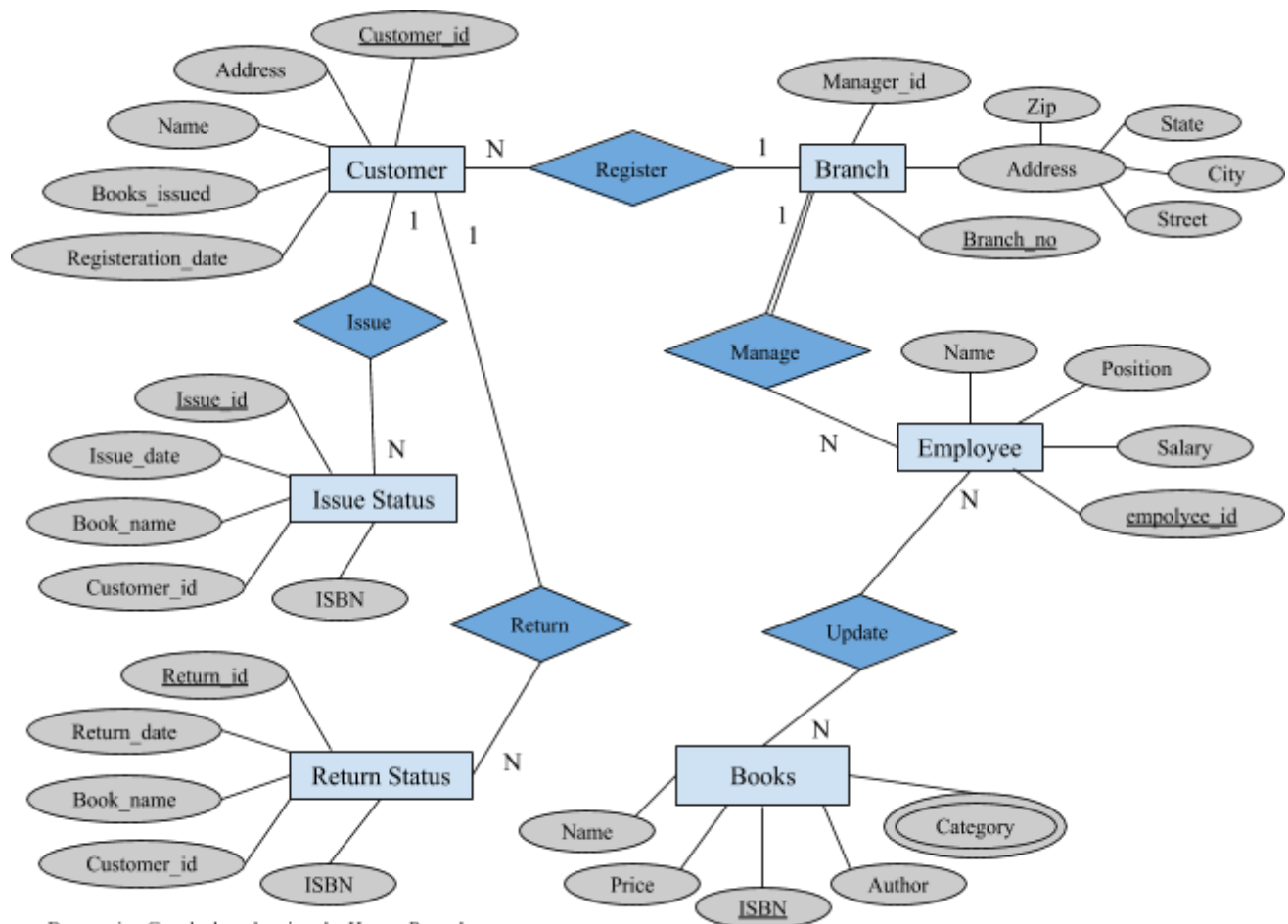
Each book has a name, price, author, category, and unique book ISBN. Each book can be updated with an employee and can be sold by the customer.

The system also records all details about customers, Each customer has name, address, and unique id number. Also customer can register a branch and the system can track the registration date and can issue or return a book and also the system track the number of issue books for a customer.

The system tracks information about each book return such as return id number, return date, book name, book unique number (ISBN), and customer id number. Also, the same for each book issue it records issue id number, issue date, book name, ISBN, and customer id number.

ERD: stands for Entity Relationship Diagram, It is a relational schema for database design that used to design the main logic structure of the database. It is commonly used because its approach in representing data is so much easy to understand and also effective.

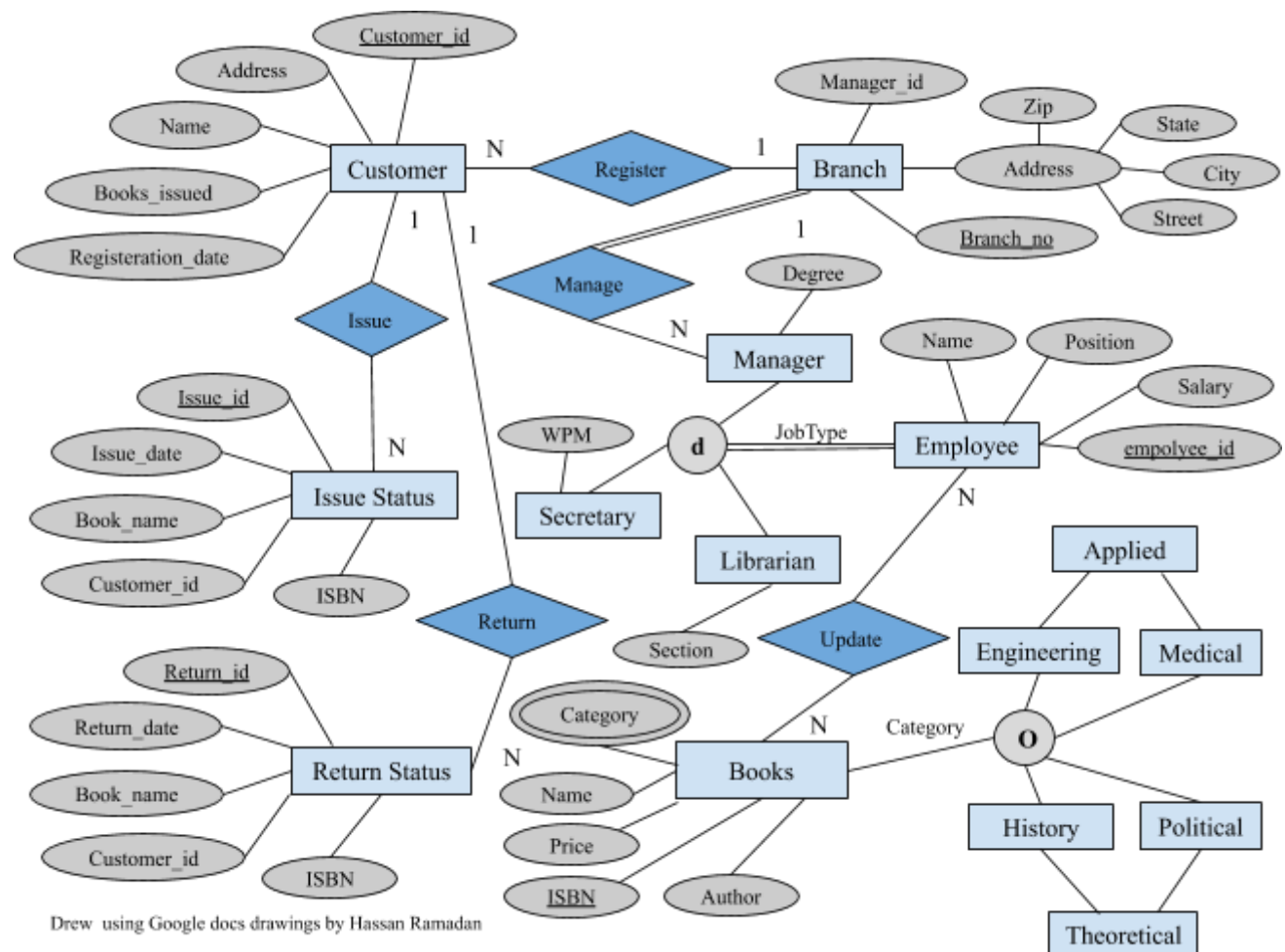
LIBRARY ER Diagram:



Drew using Google docs drawings by Hassan Ramadan

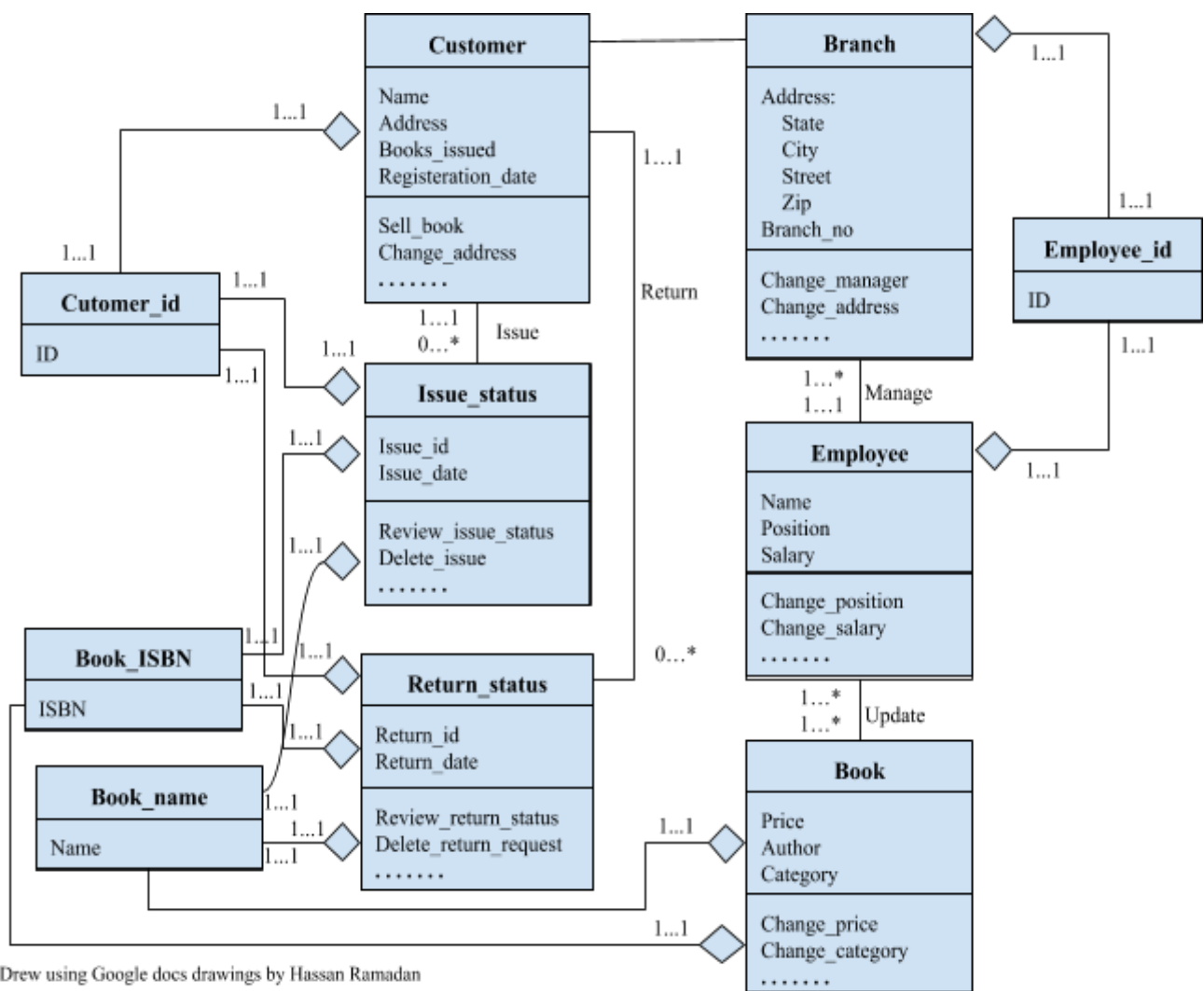
EERD: stands for Enhanced Entity Relationship Diagram, which is just an ERD with some advanced concepts like generalization & specialization concept, constraints, and much more.

LIBRARY EER Diagram:

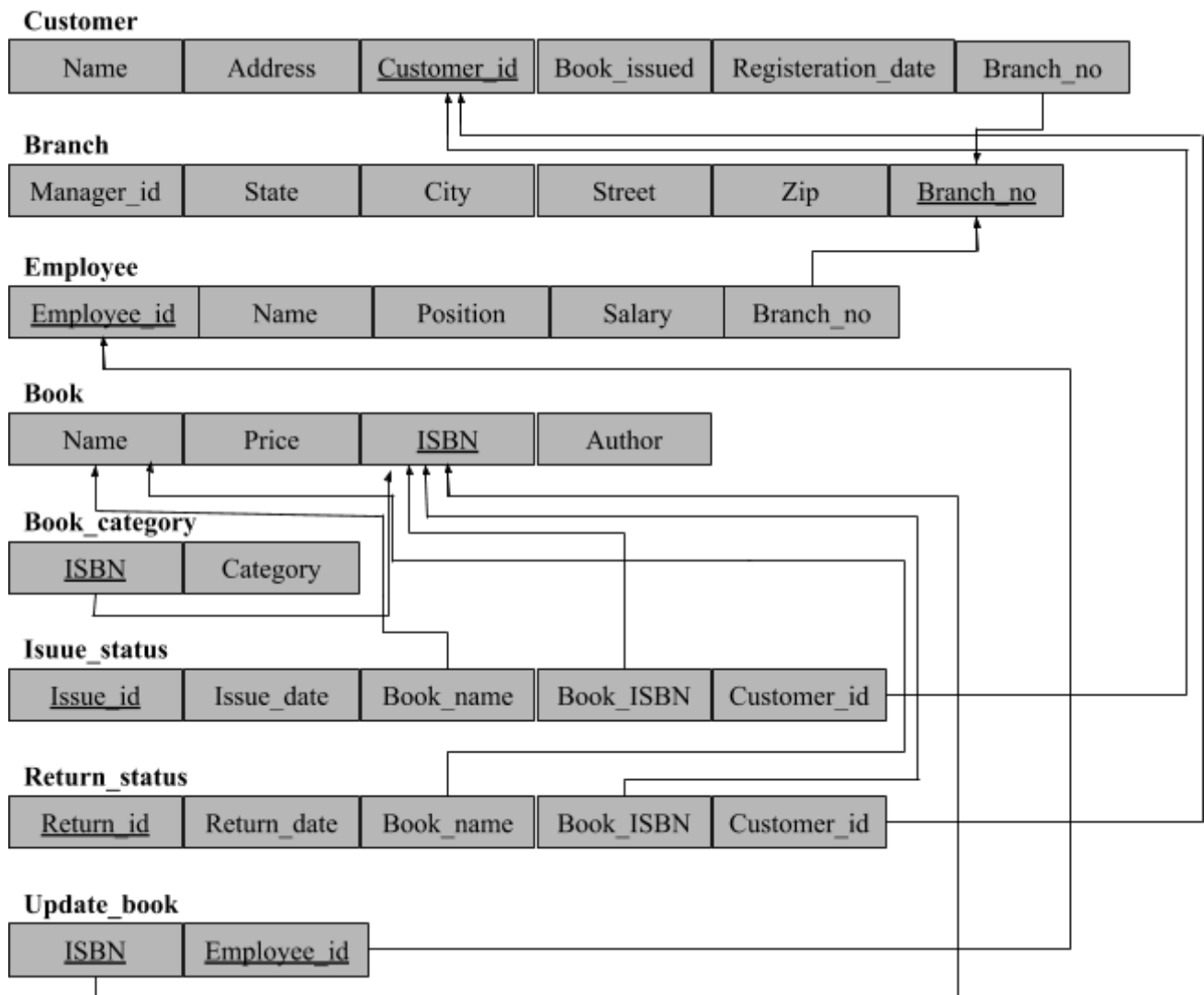


UML: stands for Unified Modeling Language which consists of some diagrams and concepts to visualize the main structure of the system. It is another notion to represent and model the database schema for any system.

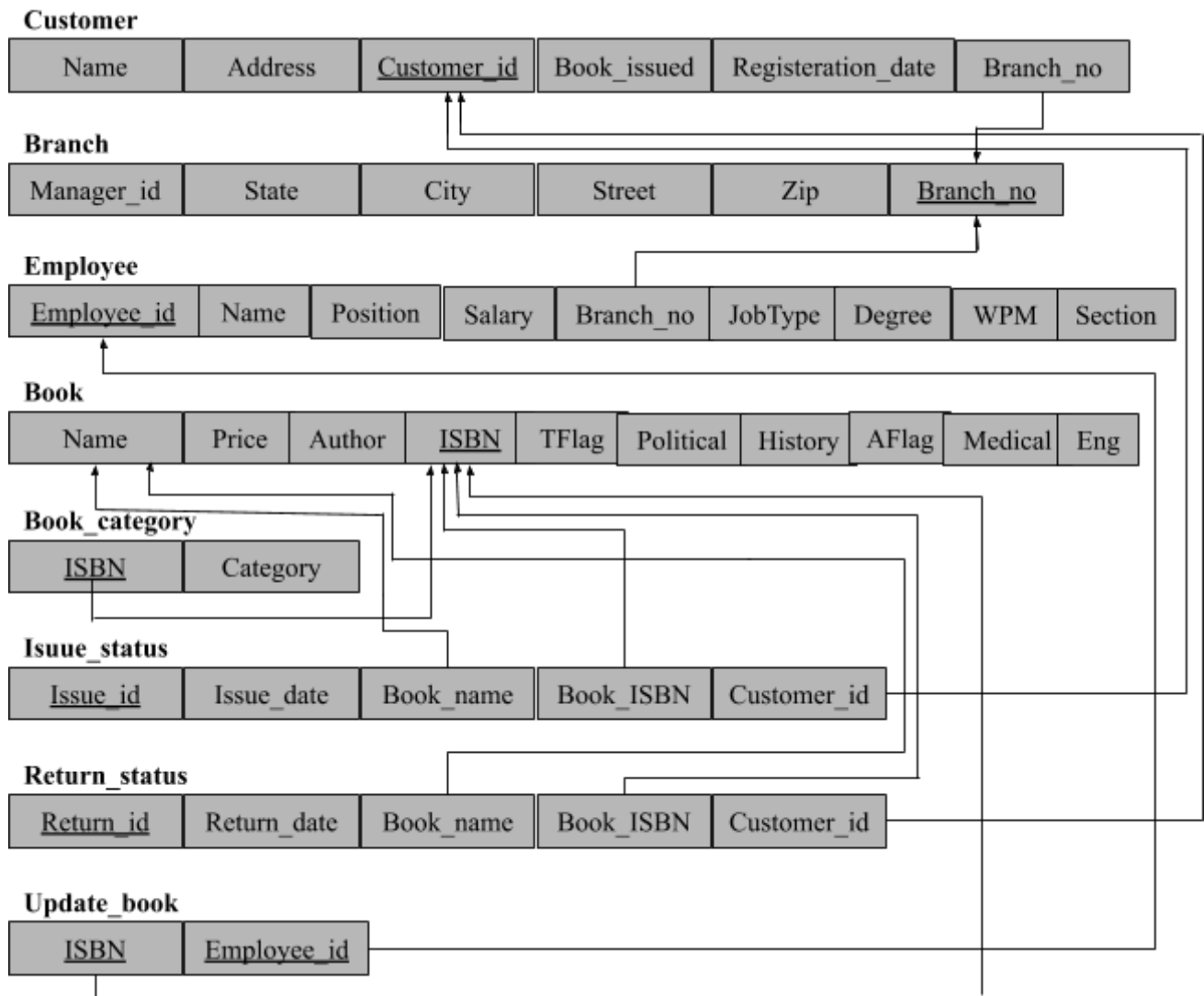
LIBRARY UML Diagram:



Mapping ERD to relational schema:



Mapping EERD to relational schema:



Normalization: is the process of organizing data in relations by providing an approach of guidelines to avoid the popular problems we can face when trying to design a database like redundancy, insertion, deletion, and updating anomalies.

This concept applies by applying all the following normal forms:

1st Normal Form(1NF):

This normal form ensures that all attributes are singlevalued or atomic attributes, So all multivalued attributes must come in another relations with the key attribute of the entity. And, composite attributes must be replaced with its sub-attributes. Also, all attributes must have unique names.

All these rules applied in our LIBRARY database design such as Category (multivalued attribute) come on a Book_category (other relation) with the key attribute (ISBN).

And, Address (composite attribute) replaced with State, City, Street, Zip (sub-attributes), So LIBRARY design is in the 1NF.

2nd Normal Form (2NF):

This normal form ensures that the database design is in 1NF and all relations do not have partial dependency. So, all attributes which have partial dependency comes in another relation with the key attribute.

All these rules applied in LIBRARY database design. Such as, all partial dependencies in relations. So LIBRARY design is in 2NF.

3rd Normal Form (3NF):

This normal form ensures that the database design is in 2NF and all relations do not have transitive dependency. So, all attributes which have transitive dependency comes in another relation with the non-prime attribute and convert this attribute to a prime attribute.

All these rules applied in LIBRARY database design. Such as, Udate_book relationship. So LIBRARY design is in 3NF.

Boyce and Codd Normal Form:

This normal form ensures that the database design is in 3NF and all relations do not have non-prime attribute determines another non-prime attribute and non-transitive. So, all these attributes come in another relation with the non-prime attribute and convert this attribute to a prime attribute.

So, The LIBRARY database design is normalized, this is the best way to apply the normalization, and structure data without redundancy or any anomaly such as insertion, deletion, or even updating.

SQL queries for creation:

```
create database LIBRARY;
```

```
use LIBRARY;
```

```
create table BOOKS(ISBN int(100) not null, name varchar(50) not null, category varchar(50) not null, price int(10) not null, author varchar(50) not null, primary key(ISBN));
```

```
create table EMPLOYEE(employee_id int(10) not null, name varchar(50) not null, position varchar(30) not null, salary int(10) not null, primary key(employee_id));
```

```
create table CUSTOMER(customer_id int(10) not null, name varchar(50) not null, address varchar(100) not null, registration_date date not null, primary key(customer_id));
```

```
create table BRANCH(branch_no int(10) not null, manager_id int(10) not null, address varchar(100) not null, primary key(branch_no), foreign key(manager_id) references employee(employee_id));
```

```
create table ISSUE_STATUS(issue_id int(10) not null, customer_id int(10) not null, book_name varchar(50) not null, issue_date date not null, ISBN int(100) not null, primary key(issue_id), foreign key(ISBN) references BOOKS(ISBN), foreign key(customer_id) references customer(customer_id));
```

```
create table RETURN_STATUS(return_id int(10) not null, customer_id int(10) not null, book_name varchar(50) not null, return_date date not null, ISBN int(100) not null, primary key(return_id), foreign key(ISBN) references BOOKS(ISBN), foreign key(customer_id) references issue_status(customer_id));
```

Database is ready to store data, show data stored, edit any piece of information on tables or even tables headers and maintain structure or relations.

some operations on database:

```
insert into books values(1001,'Fundamentals of Database Systems', 'engineering', 70, 'Ramez Elmasri');
```

```
select name from books;
```

many more ...

3. Conclusion

As mentioned before the library database management system can track all details about all entities of the library. This system converted all processes and operations to be in the digital form. So, this way make all operation which depends on these operations very fast. This project enable us to reduce the waste of time, the difficulty to maintain information, and many more of these problems.

4. References

[1] Elmasri, R. and Navathe, S.B. (2017) Fundamentals of Database Systems. 3rd Edition, Addison-Wesley, Boston.