

# **3ANGLE**



**Addis Ababa Institute of Technology  
School of Electrical and Computer Engineering Computer  
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**Library Management System Application  
Software Requirements Analysis and complete ER Diagram**

## **GROUP - 8**

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## **Introduction:**

A library management system is a software framework that refers to small or medium-sized library systems. It is used by librarians to operate the library using a computerized framework in which they can log multiple transactions such as book issues, book returns, new book additions, new student additions, and so on. The system can also track the issued books in accordance with their due data to calculate the amount of fine a delayed user would have to pay in returning the book.

## Definition:

**DBMS-** A **database management system (DBMS)** is a software package designed to define, manipulate, retrieve and manage data in a database.

**ISBN** - international standard Book number

**Entity** - An entity is an object or component of data. An entity is represented as a rectangle in an ER diagram.

**Attribute** - An attribute describes the property of an entity. An attribute is represented as Oval in an ER diagram. We'll be using three types of attributes in this project:

- **Key Attribute** - A key attribute can uniquely identify an entity from an entity set.
- **Composite Attribute** - An attribute that is a combination of other attributes is known as a composite attribute.
- **Derived Attribute** - An attribute that can hold multiple values is known as a multivalued attribute.
- **Multi-valued Attribute** - A derived attribute is one whose value is dynamic and derived from another attribute. It is represented by a **dashed oval** in an ER Diagram.

**Relationship** - A derived attribute is one whose value is dynamic and derived from another attribute. It is represented by a dashed oval in an ER Diagram.

**ER** - Entity-relationship

## Reference

**Tutorial Points :** (DBMS tutorial) <https://www.tutorialspoint.com/>

Design a Library Management System <https://www.educative.io/>

## **Problem Definition:**

Our project on library management system gives the user complete information about the library. It is possible to enter the record of the new books and retrieve the details of the books in the library. It is also possible to issue the books to the student and maintain their records. We can also check how many books are issued and stock available in the library.

In our project, the focus has been on presenting information about the library in general and related services thereof in an easy and intelligible manner.

## **Drawbacks in current library management systems:**

1. Lack of immediate information retrieval
2. Lack of prompt updating
3. Redundancy information
4. Difficulty tracking a book.
5. Slow report generation, and many more.

Generally, the administration in current libraries is done manually by the librarians. Including maintaining the records, searching and adding new book records, handling all manually using slip in the drover is very hard and inefficient. Our project is designed to make an automated DB system to ease the work of the librarian and efficiently handle operations like issuing a book, tracking it, and so on.

## **What our system is going to improve:**

Here, the improvements that are going to be done using our system are listed below. This library management system will:

1. provide efficient service to members
2. Reduce the workload of the librarians
3. Bring about a relatively faster information retrieval about a book.
4. Provide more security of data

## **More about the proposed system:**

We want by the end of this project to deliver a comprehensive library management system that's suitable for libraries of any size and any type. The usability will range from small libraries to large ones, public libraries, school libraries, and research libraries alike.

Solutions that our system is going to provide are as follows.

1. Reduction of unnecessary labor by the librarians
2. Fast retrieval of information about a book
3. Easy access to every book stored in the library.
4. Provides excellent and efficient services to members and those of improvements listed in the section about.

## Key features of our system:

This software is designed to be capable of handling all book-related issues in the library. Issuing, returning, and searching books in the database. Moreover, the system will also allow the addition of new records and tracking of issued books.

The key features of our system are:

- Any library member should be able to search books by their title, author, subject category as well by publication date.
- There could be more than one copy of a book, and library members should be able to check out and reserve any copy. We will call each copy of a book, a book item.
- Members should be allowed to place reservations for books that are already unavailable.
- The system should be able to access/retrieve information such as who took a specific book or which books a specific library user has checked out.
- The number of books a member should check out should be limited to three (3), the system will not allow more check-out requests.
- The number of days a member can keep the books he checks out is limited to 7 days, i.e, if a member wants to keep them any longer he/she must return the books first and then check them out again.
- Members should be allowed to place reservations for books that are already unavailable.
- Fines for books returned after the due date should be eligible to be collected by the scheme.
- The system should be able to send notifications whenever the reserved books become available, as well as when the book is not returned within the due date.



- A special barcode will be printed on each book and member's passport. Books and library cards will have barcodes that the device will be able to scan.

## Entities and related attributes:

The ER Model has the power of expressing database entities in a conceptual hierarchical manner. As the hierarchy goes up, it generalizes the view of entities, and as we go deep in the hierarchy, it gives us the detail of every entity included.

Going up in this structure is called generalization, where entities are clubbed together to represent a more generalized view.

In this project, there are 7 Entities, namely, **Book entity**, **Person entity**, **User entity**, **Publisher entity**, **Authentication system**, **Report entity**, and **Staff entity**. Each of those entities are designed to interact with one another through relations, specification (IS-A), and Inheritance.

In this particular project, we've also used all four kinds of relationships between entities, that is, one-to-one, one-to-many, many-to-one, and many to many. All of this relationship is shown in the ER diagram at the end of this document.

## 1. Book Entity

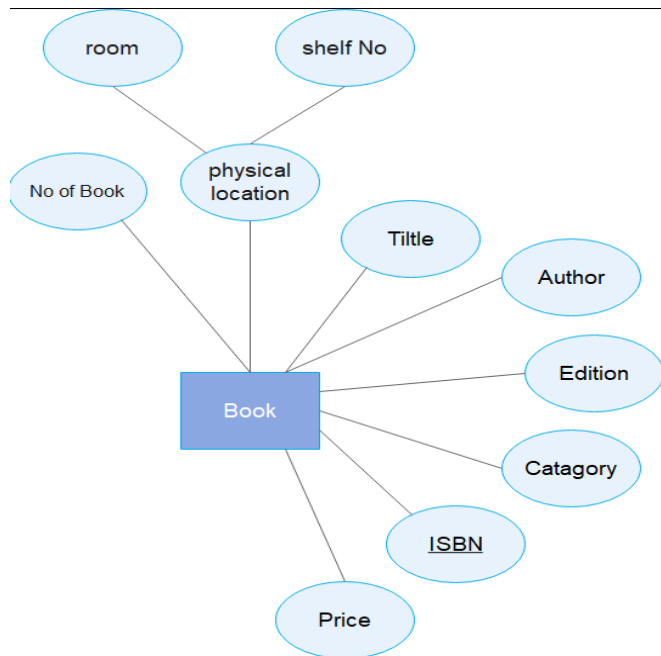


fig 1: Book entity

### Book entity:

- ❖ is an object of book data in which numerous pieces of information are stored about.
- ❖ The details of this object are expressed as an attribute.

Book entity has the following attribute as shown in the figure below.

#### ❖ Attributes:

- **Price:** the price of a specific book
  - **ISBN:** international standard Book number/primary key
  - **Category:** category of books, like novels, history, science...
  - **Edition:** the year in which a book is published and for how many times it has been published.
  - **Author:** the author of a specific book
  - **Title:** the title of the book
  - **No of books:** how many books there are in the library
  - **Physical location:** the actual location of a book in the library.
- ❖ There are also two elements of the composite attribute **physical location**:
- **room:** the room where the book is put.
  - **shelf No:** the shelf number where the book is found

## 2. User Entity

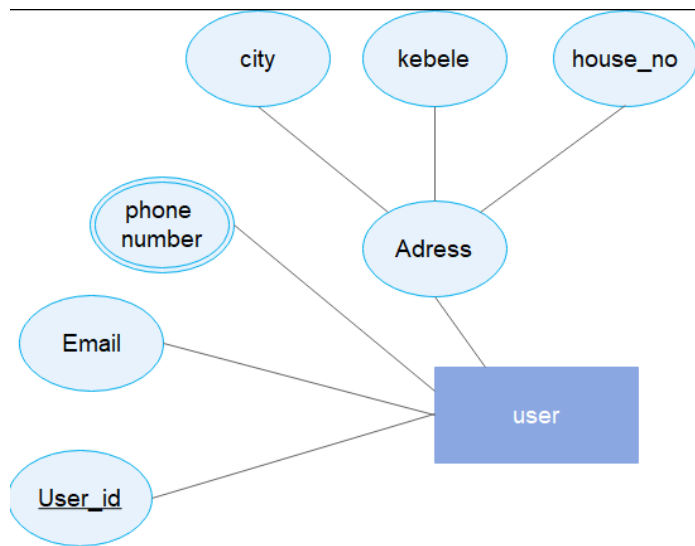


fig 2:User Entity

### User entity:

- ❖ A user can be anyone who can register and borrow a book.
- ❖ The User Entity consists of 4 attributes that are used to create a new account.
- ❖ **ATTRIBUTES:**
  - **User\_id:** user\_id is used to identify a single user and no one can have any similar. Because of this, we make it a **Primary Key**.
  - **Phone-number:** a multi-valued attribute that holds the phone number of a user.
  - **Address:** is a composite attribute that consists of:
    - City
    - Kebele
    - house\_no.
  - **Email:** the email address of the user

The **User Entity** will also inherit attributes from its parent entity (**Person**).

### 3. Person Entity

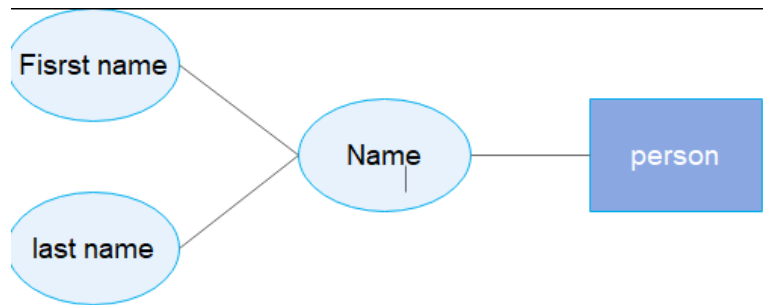


fig 3:Person Entity

#### Parent entity:

- ❖ **Person entity** consists of one single attribute (**Name**) which is a composite attribute which in turn has two attributes: **first name** and **last name**.
- ❖ **Person entity** is inherited by two other entities (**User**, and **Staff**) so that its attributes will be inherited to reduce redundancy.

### 4 . Publisher Entity

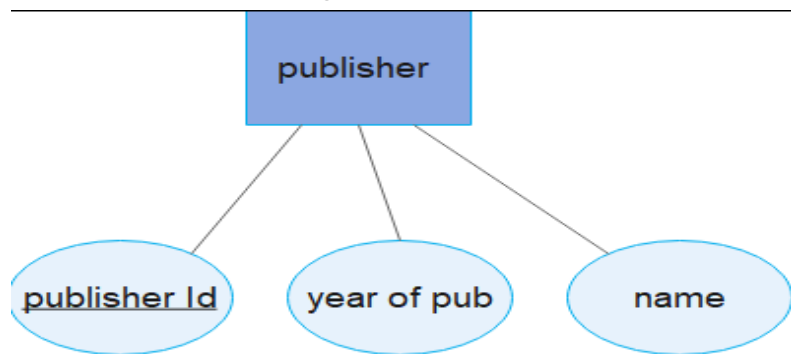


fig 4: Publisher Entity

#### Publisher entity:

- ❖ The **publisher entity** contains details about the publisher through its three single attributes.

#### Attributes:

- **name** - holds the name of the publisher.
- **year of pub** - holds the exact year a specific book is published.
- **publisher Id** - a key to identify a particular publisher. It is a primary key

## 5. Authentication System entity

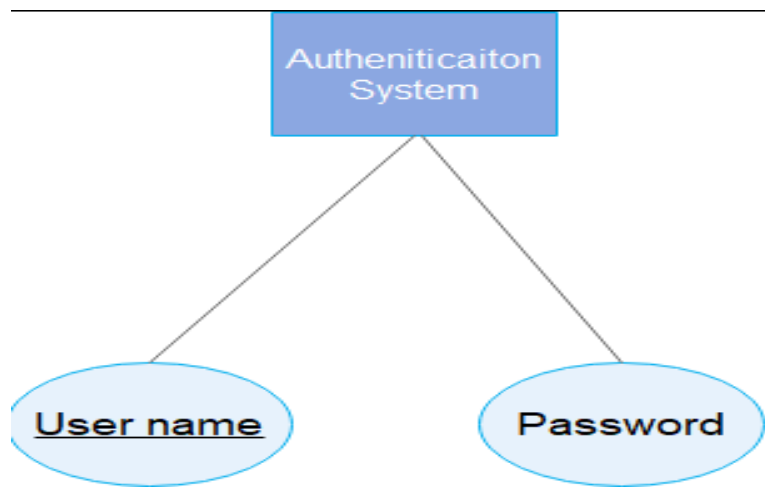


fig 5:Authentication Entity

### Authentication System entity:

- ❖ Authentication system entity holds the credentials of **Person entity**.
- ❖ **Attributes:**
  - **User\_name:** a specific name that can't be repeated by which a subscriber is identified.
  - **Password:** a security passkey of **Person entity** to access the system and related information related to his account.

## 6. Report Entity

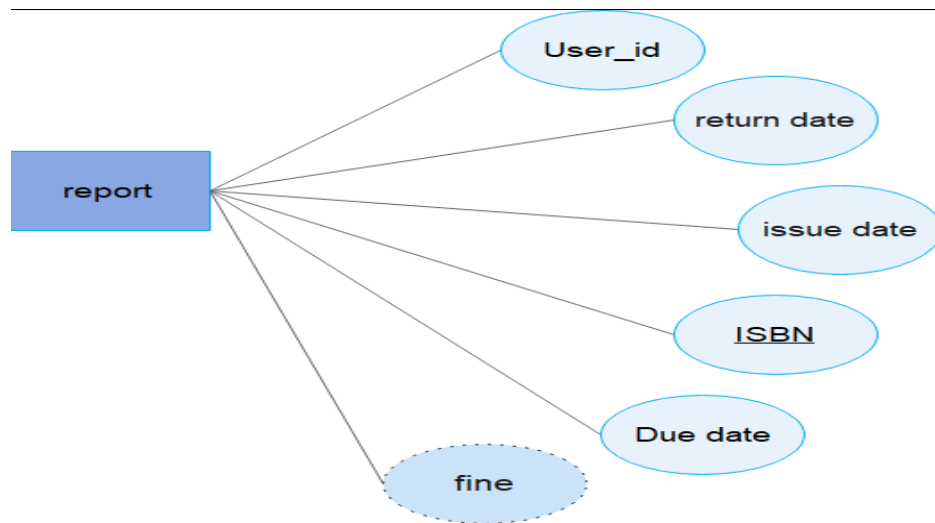


fig 6:Report Entity

### Report Entity:

- ❖ We used Report Entity to register a user who wants to issue a book from the library. The status related to the issued book will be stored notifying the staff about it. In other words, the staff got to control the status of the books and fines related to the return of the issued books.
- ❖ **Attributes:**
  - **User\_id:** the identification key of a user
  - **Return\_date:** a date a book issued is returned
  - **Issue\_date:** the date a book is issued.
  - **ISBN:** international standard Book number. It is a primary key.
  - **fine/Driver entity:** a penalty of money on a user who delayed the due date
  - **Due\_date:** the date specified for a book issued to be returned.

## 6. Staff Entity

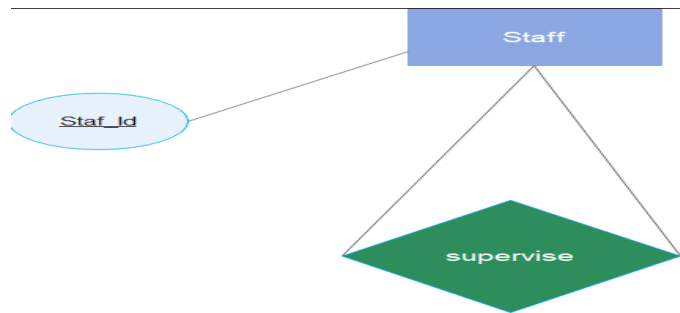


fig 7: Staff Entity

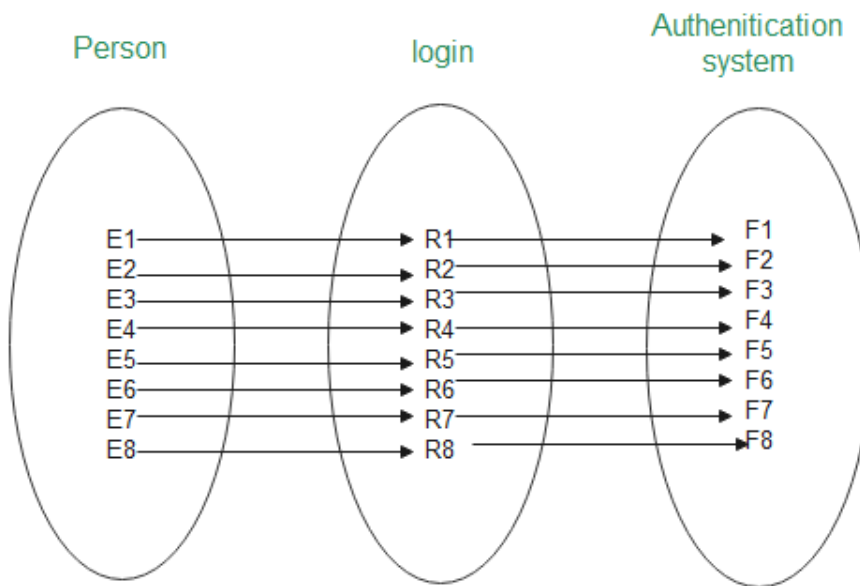
### Staff Entity:

- ❖ **Staff entities** can be a librarian or other staff members who control the library.
- ❖ **Attribute:**
  - **Staf\_id:** is a unique id that is given to staff members. It is a Primary key.
- ❖ **Supervise:**
  - It has a 1 to N relation which means staff has its supervisor and supervisee. Supervisors can have control over staff members.

## Relationships between entities

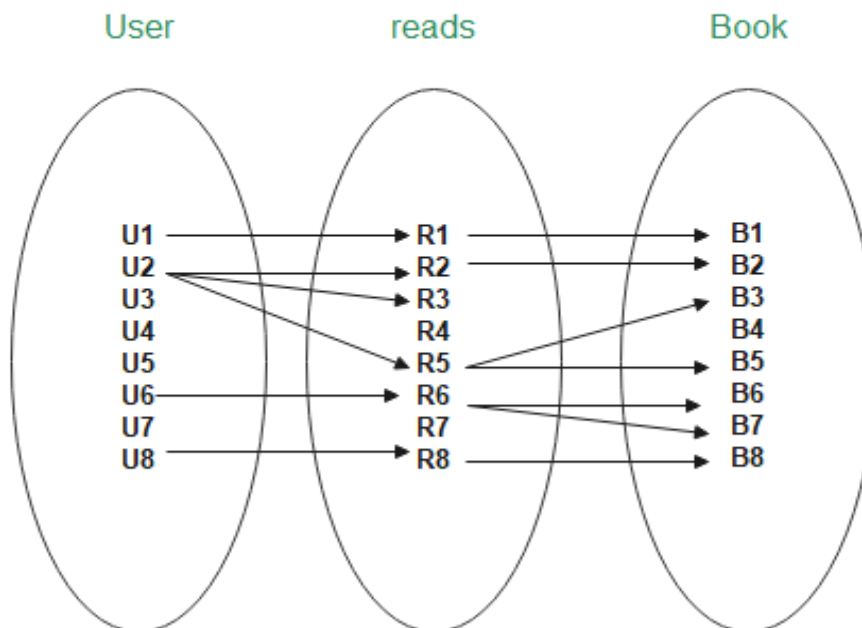
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one to one relation ship between person and authentication system



person:authentication => 1:1

many to many relation ship between user and Book

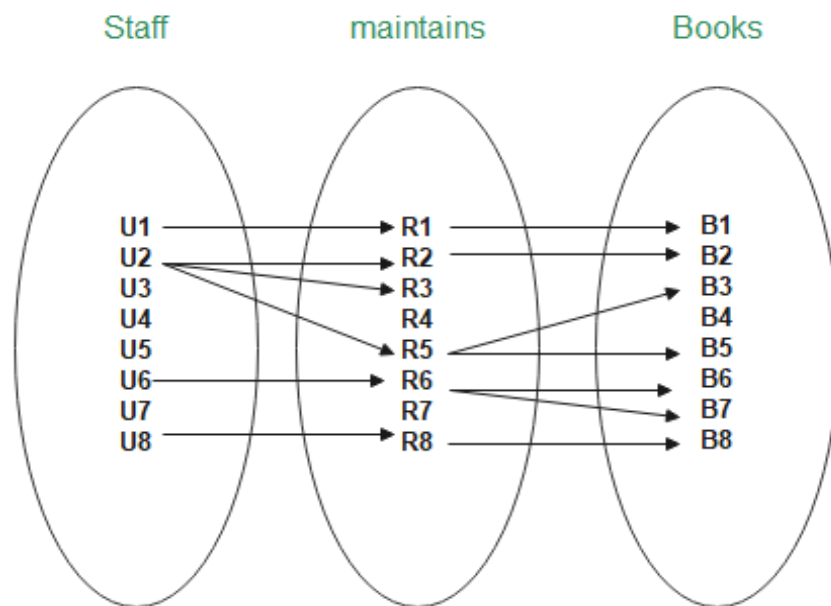


User:book => N:M

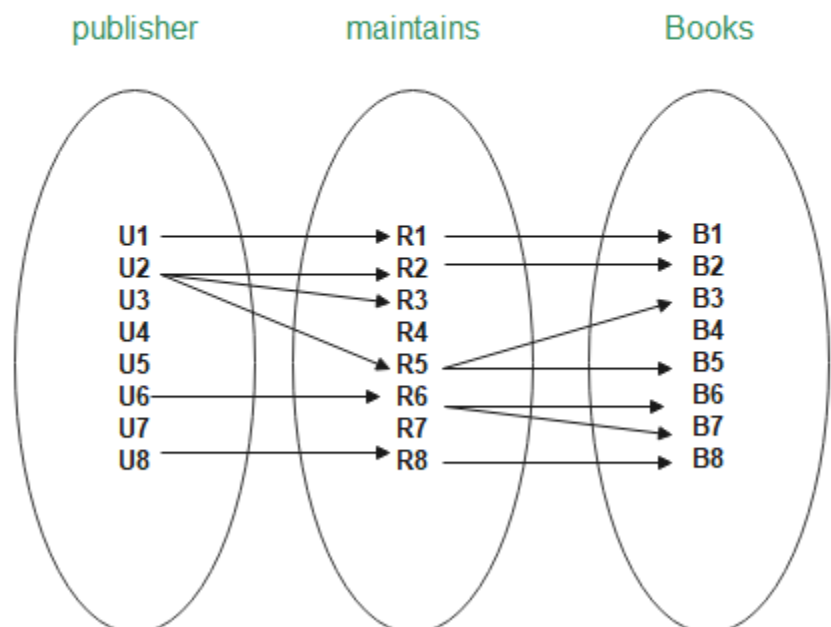


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many to many relation ship between Staff and Books

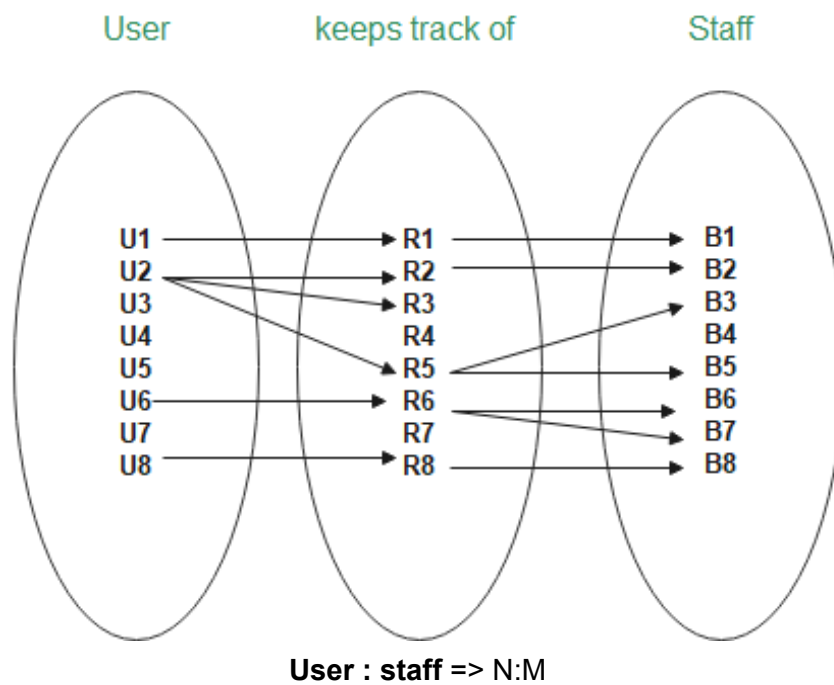


many to many relation ship between publisher and Books



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many to many relation ship between user and Staff



## Entity-relationship diagram (ER)

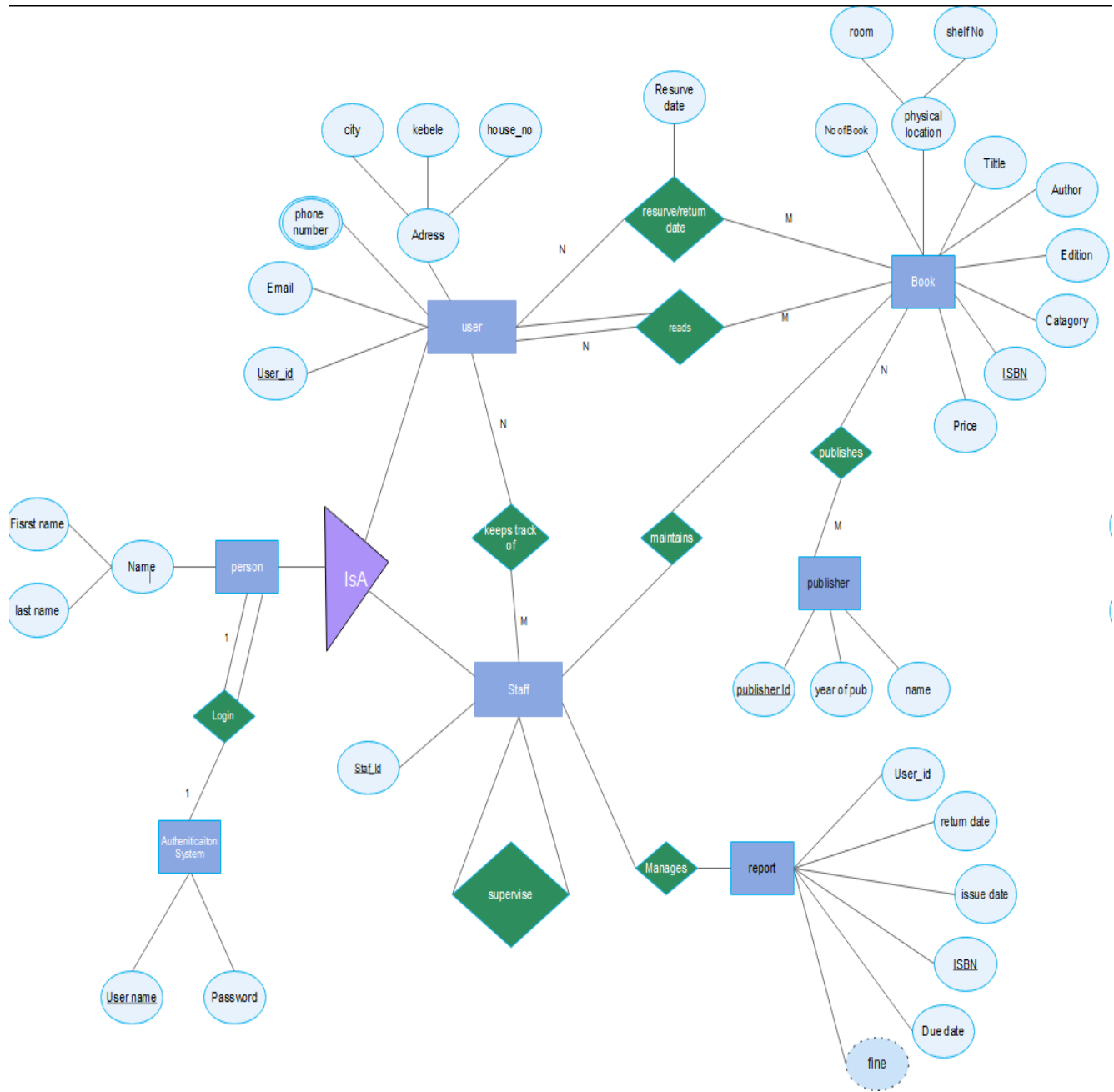


fig 8: total view of ER diagram