SECONDARY SCHOOL LIBRARY MANAGEMENT SYSTEM

Submitted by: Kris Vesselee

ID: 19647

Supervised by: Dr. Bhaskar, Vidhyacharan

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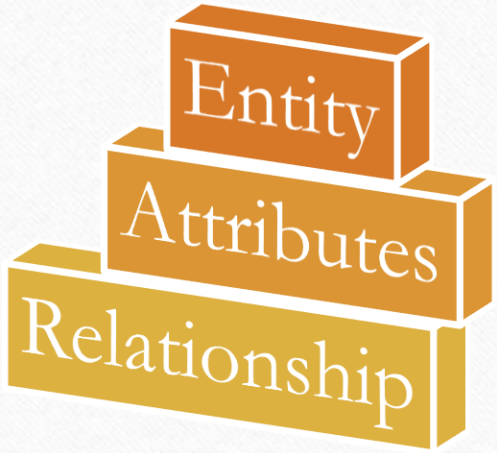
Introduction

- **Secondary School Record Management System** is a system that stores the data of various entities in a school library.
- It highlights various entities and the relationship along side the cardinality ratio that exists amongst them.
- Major entities highlighted in this system are the **Books**, **Newspapers and journal**, **Electronic assets**, **students**, and **teachers** who sometimes borrow these items from the library.

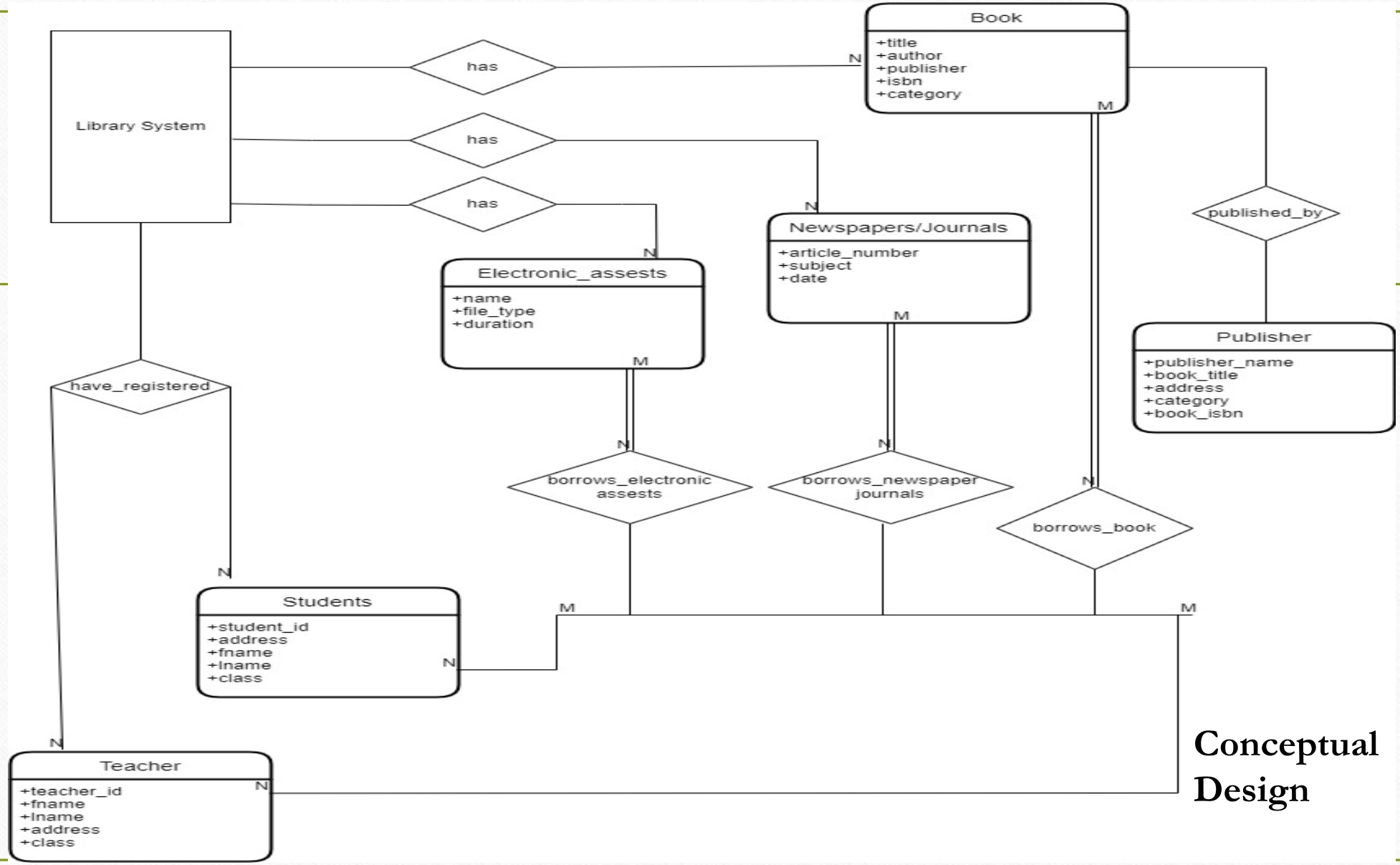
Definition and Usage of ER Diagrams

- What is ER Diagram?
- ER diagrams are used to sketch out the design of a database. By defining the entities, their attributes and showing the relationship between them, and ER diagram illustrates the logical structure of databases. ER diagrams are created based on three basic concepts:
- Entities, Attributes and Relationship.



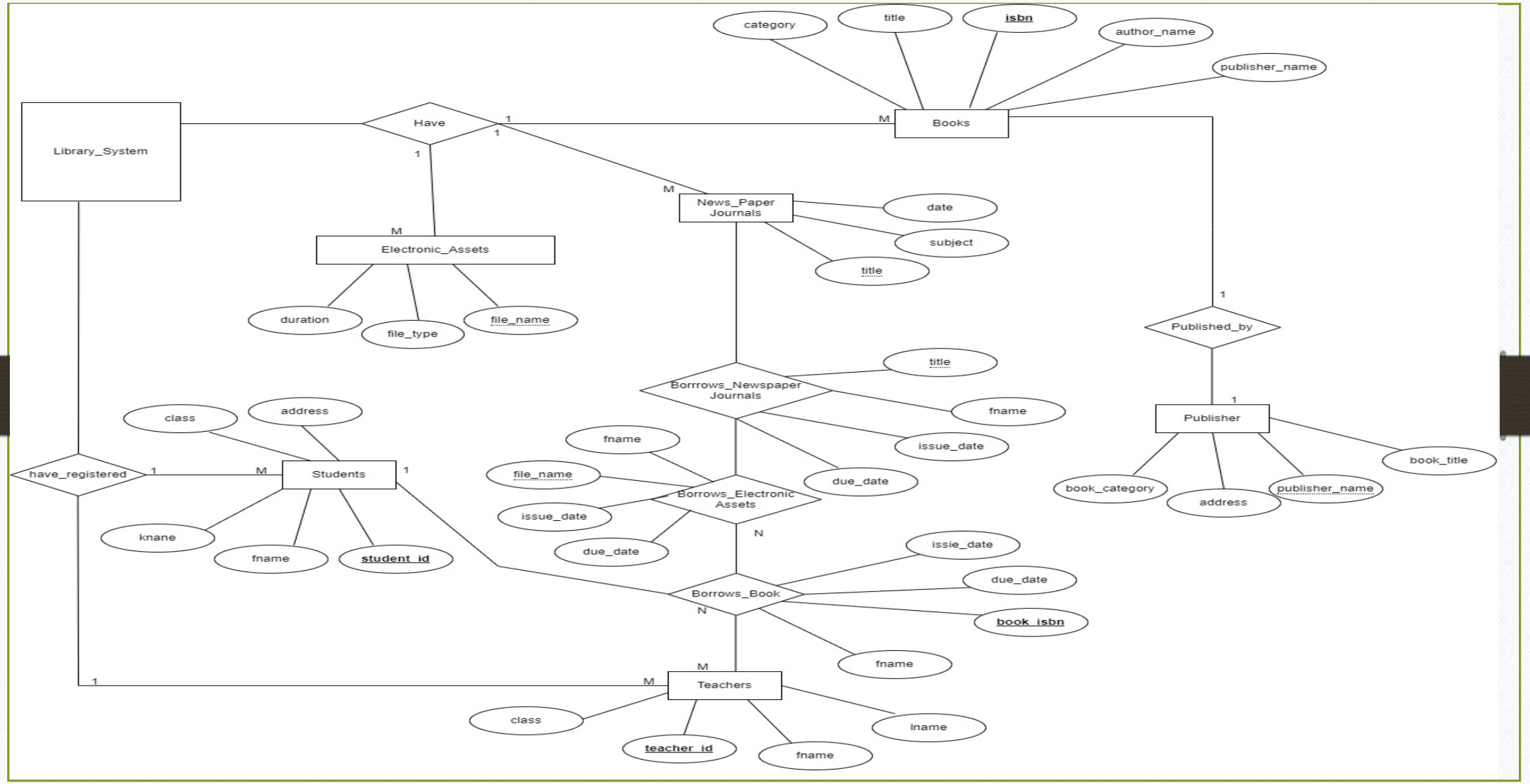
Why Use ER Diagrams?

- It helps you to define terms related to Entity relationship modeling
- It provides a preview of how all the tables should connect, what fields are going to be on each table
- It helps to describe entities, attributes and relationships
- ER diagrams are translatable into relational tables which allow you to build databases quickly.
- ER diagrams can be used by database designers as a blueprint for implementing data in specific software application.



Conceptual Design

ER DIAGRAM Secondary School Library Management System



Secondary School ER diagram Explanation

- **Book**-title, isbn, category, author, name, publisher
- **Newspaper/Journal**-title, subject, date
- **Electronic_Assests**- file_name, file_type, duration
- **Publisher**- book_title, publisher_name, address, book_category, book_isbn
- **Teacher**- teacher_id, fname, lname, address, class
- **Student**- student_id, fname, lname, address, class

Explanation of Relationship as it relates to Secondary School Library Management System

- **Have**- library has book, electronic assets, newspaper journal. Cardinality ratio is 1:N there can exist many different books in a library as well as different electronic assets and newspaper/ journals.
- **Published by**- books get published by publisher. The cardinality ratio is 1:1 one book, one publisher.
- **Borrow_book**- students, teachers borrows book from library. Cardinality ratio is M:N as many students and teachers can borrow as many books as possible.

Explanation of Relationship as it relates to Secondary School Library Management System

- **Borrow_newspaper/journal**- students and teachers borrow newspaper and journals from library. Cardinality ratio is M:N as many students can borrow as many newspaper/ journals.
- **Borrow_Electronic_assets**- students and teachers borrow newspaper and journals from library. Cardinality ratio is M:N as many students can borrow as many newspaper/ journals.
- **Have registered**- library have registered students and teachers. Cardinality ratio is 1:N as many students and teachers can register or sign up to use the library.

Books and Publisher Schema

```
MariaDB [19647vk]> select * from Books;
+--------------------+--------------------+-------------------+-----------------+----------------------+
| isbn               | title              | author_name       | category        | publisher            |
+--------------------+--------------------+-------------------+-----------------+----------------------+
| 978-0-9720295-3-7  | All about Danny    | Felecia Payne     | Fantasy         | Holiday House        |
| 978-1-62544-118-8  | Advantures of Danny| Kenny Brown       | Forklore&Fiction| Sleeping Bear Press  |
| 978-1-62544-177-5  | Alive or Not       | Matthew Larwson   | Fantasy         | Holiday House        |
| 978-1-62544-274-1  | Aquarium the       | Peter Hills       | NonFiction      | Boyds Mills Press    |
| 978-1-62544-276-5  | All my Friends     | Kethrine Peterson | Forklore&Fiction| Sleeping Bear Press  |
| 978-1-6254416-167-6| All about Danny Lap| Patrick Washington| Biography       | Chicago Review Press |
| 978-1-933624-34-1  | ABC Danny          | Patricia Johnson  | Literature      | Mighty Media House   |
| 978-1-933624-76-1  | ABC Danny          | Martha Wesleysan  | Literature      | Mighty Media House   |
+--------------------+--------------------+-------------------+-----------------+----------------------+


MariaDB [19647vk]> select * from Publisher;
+--------------------+--------------------+---------------------------+-----------------+--------------------+
| publisher_name     | book_title         | address                   | category        | book_isbn          |
+--------------------+--------------------+---------------------------+-----------------+--------------------+
| Mighty Media House | ABC Danny          | 123,Mission Strees,CA     | Literature      | 978-1-933624-76-1  |
| Sleeping Bear Press| All my Friends     | 431,Waters Bolevard,TX    | Forklore&Fiction| 978-1-62544-118-8  |
| Holiday House      | All about Danny    | 159,Walking Avenue,NY     | Fantasy         | 978-0-9720295-3-7  |
| Chicago Press Review| All about Danny Lap| 412,Charleston Avenue,GA | Biography       | 978-1-6254416-167-6|
| Bodys MIlls Press  | Aquarium the       | 257,Wellington Boulevard,CA| NonFiction     | 978-1-62544-274-1  |
+--------------------+--------------------+---------------------------+-----------------+--------------------+
```

Students and Teachers Schema

```
MariaDB [19647vk]> select * from Students;
+------------+----------------------+-----------+------------+-------+
| student_id | address              | fname     | lname      | class |
+------------+----------------------+-----------+------------+-------+
|          1 | 123,Skills Hills     | May       | Lawrence   |    10 |
|          2 | 245,Stroller City    | Nathan    | Benson     |    11 |
|          3 | 213,Hunting Avenue   | Boys      | King       |    10 |
|          4 | Valley Town          | Kate      | MIller     |    12 |
|          5 | 312 Nashville Street | Jack      | Tisdel     |    11 |
|          6 | 426 Lakes Town       | Matt      | Washington |    12 |
|          7 | 142 Mountain Avenue  | Turner    | Wilson     |    10 |
|          8 | 219 Moving City      | Elizabeth | Tucker     |    11 |
|          9 | 342 Village Palace   | Molly     | Reddington |    12 |
+------------+----------------------+-----------+------------+-------+


MariaDB [19647vk]> select * from Teacher;
+------------+---------+-----------+-----------------------+-------+
| teacher_id | fname   | lname     | address               | class |
+------------+---------+-----------+-----------------------+-------+
|          1 | Jayson  | Robertson | 357,Robin Street      |    10 |
|          2 | Rebecca | Lawson    | 331,Newton Boulevard  |    11 |
|          3 | Roland  | Fetcher   | 410,Washington Street |    12 |
+------------+---------+-----------+-----------------------+-------+
```

Electronic Assets, Newspaper & Journals Schema

```
MariaDB [19647vk]> select * from Electronic_Assets;
+-----------------------------+-----------+----------------+
| name                        | file_type | file_duration  |
+-----------------------------+-----------+----------------+
| The Crytic Listener         | MP3       | 01:00:00       |
| Microbiology                | MP4       | 01:30:00       |
| Language Guide              | MP3       | 02:00:30       |
| History of Psycology        | MP4       | 01:45:10       |
| Managing Finance Economics  | AVI       | 03:00:00       |
| Essence of Business&Law     | MP4       | 02:30:40       |
+-----------------------------+-----------+----------------+

MariaDB [19647vk]> select * from Newspaper_Journals;
+----------------------+--------------------+-------------+
| article_name         | subject            | date        |
+----------------------+--------------------+-------------+
| The Atlas            | Language Variants  | 2008-05-10  |
| USA Today            | Super Tuesday      | 2008-07-17  |
| New York Times       | The Stock Market   | 2019-02-28  |
| Los Angeles Times    | Hurricane Laura    | 2020-09-18  |
| Newsday              | Australia Fires    | 2021-04-14  |
| Washington Post      | Murder Hornet      | 2021-05-20  |
| Wall Street Journal  | Unemployment       | 2021-04-18  |
| Star Tribune         | Stimulus Checks    | 2020-11-06  |
| The Boston Globe     | Iran               | 2021-12-26  |
+----------------------+--------------------+-------------+
```

Borrows Book Schema

```
MariaDB [19647vk]> select * from Borrows_Book;
+--------------------+--------+------------+------------+
| book_isbn          | fname  | issue_date | due_date   |
+--------------------+--------+------------+------------+
| 978-1-933624-76-1  | Kate   | 2021-06-23 | 2021-08-17 |
| 978-1-62544-177-5  | Matt   | 2021-05-17 | 2021-09-10 |
| 978-0-9720295-3-7  | Jayson | 2021-02-17 | 2021-06-19 |
| 978-1-6254416-167-6 | Lawson | 2021-05-16 | 2021-10-28 |
| 978-1-62544-276-5  | Jack   | 2021-08-19 | 2021-11-21 |
+--------------------+--------+------------+------------+
```

Borrows Electronic Assets ,Newspaper & Journals Schema

```
MariaDB [19647vk]> select * from Borrows_Electronic;
+--------------------------+---------+------------+------------+
| file_name                | fname   | issue_date | due_date   |
+--------------------------+---------+------------+------------+
| The Crytic Listener      | Boys    | 2021-04-19 | 2021-08-05 |
| Microbiology             | Turner  | 2021-05-14 | 2021-09-10 |
| History of Psycology     | Roland  | 2021-09-25 | 2021-01-05 |
| Managing Finance Economy | Rebecca | 2021-02-22 | 2021-10-25 |
| Essence of Business&law  | Molly   | 2021-06-27 | 2021-09-23 |
+--------------------------+---------+------------+------------+


MariaDB [19647vk]> select * from Borrows_Newspaper_Journal;
+---------------+---------+------------+------------+
| title         | fname   | issue_date | due_date   |
+---------------+---------+------------+------------+
| The Atlas     | Jayson  | 2021-01-22 | 2021-05-17 |
| USA Today     | May     | 2021-07-02 | 2021-08-18 |
| Newsday       | Kate    | 2021-04-15 | 2021-02-20 |
| Star Tribune  | Matt    | 2021-08-21 | 2021-07-16 |
| New York Times | Fetcher | 2021-09-01 | 2021-11-23 |
+---------------+---------+------------+------------+
```

List of Some SQL Queries and Output

Q1. Select b_isbn,author_name,category from Books where publisher name is Holiday 'House'.

```
MariaDB [19647vk]> select b.isbn,b.title,b.author_name,b.category from Books b where b.publisher='Holiday House';
+------------------+----------------+----------------+----------+
| isbn             | title          | author_name    | category |
+------------------+----------------+----------------+----------+
| 978-0-9720295-3-7 | All about Danny | Felecia Payne   | Fantasy  |
| 978-1-62544-177-5 | Alive or Not    | Matthew Larwson | Fantasy  |
+------------------+----------------+----------------+----------+
```

Relational Algebra Expression:

HLDY_HS←σpublisher_name='Holiday Holiday'(Publisher)

Π isbn,title,author_name,category(HLDY_HS)

List of Some SQL Queries and Output

Q2. Select name,file type, duration from Electronis Assets where file type is ‘MP4’

```
MariaDB [19647vk]> select e.name,e.file_type,e.file_duration from Electronic_Assets e where e.file_type='MP4';
+-------------------------+-----------+---------------+
| name                    | file_type | file_duration |
+-------------------------+-----------+---------------+
| Microbiology            | MP4       | 01:30:00      |
| History of Psycology    | MP4       | 01:45:10      |
| Essence of Business&Law | MP4       | 02:30:40      |
+-------------------------+-----------+---------------+
```

Relational Algebra Expression:

MP4_FILE←σfile_type=‘MP4’(Electronic_Assets)

Π name,file type, duration(MP4_FILE)

List of Some SQL Queries and Output

Q3. Select article name, subject, date from Newspaper Journals where date is greater than '2020-01-01

```
MariaDB [19647vk]> select n.article_name,n.subject, n.date from Newspaper_Journa
ls n  where n.date>'2020-01-01';
+--------------------+-----------------+------------+
| article_name       | subject         | date       |
+--------------------+-----------------+------------+
| Los Angeles Times  | Hurricane Laura | 2020-09-18 |
| Newsday            | Australia Fires | 2021-04-14 |
| Washington Post    | Murder Hornet   | 2021-05-20 |
| Wall Street Journal | Unemployment   | 2021-04-18 |
| Star Tribune       | Stimulus Checks | 2020-11-06 |
| The Boston Globe   | Iran            | 2021-12-26 |
+--------------------+-----------------+------------+
```

Relational Algebra Expression:

DATE←σdate>'2020-01 01'(Newspaper_Journals)

Π article_name,subject, date(DATE)

List of Some SQL Queries and Output

Q4. Select student_id, address, fname from Students where class is greater than '10'

```
MariaDB [19647vk]> select s.lname,s.fname,s.class,bb.issue_date from Students s,Borrows_Book bb  where s.fname=bb.fname and s.class>10;
+------------+-------+-------+------------+
| lname      | fname | class | issue_date |
+------------+-------+-------+------------+
| MIller     | Kate  |    12 | 2021-06-23 |
| Tisdel     | Jack  |    11 | 2021-08-19 |
| Washington | Matt  |    12 | 2021-05-17 |
+------------+-------+-------+------------+
```

Relational Algebra Expression:

CLASS_10_STUDS← σ class>10(Students)
Result←Π fname, lname, class (**CLASS_10_STUDS**)

List of Some SQL Queries and Output

Q5. Select lname,fname,issue date from Students and Borrows Book table where student 'fname' equals Borrows book 'fname'

```
MariaDB [19647vk]> select s.lname,s.fname,s.class,bb.issue_date from Students s,Borrows_Book bb  where s.fname=bb.fname;
+------------+-------+-------+------------+
| lname      | fname | class | issue_date |
+------------+-------+-------+------------+
| MIller     | Kate  |    12 | 2021-06-23 |
| Tisdel     | Jack  |    11 | 2021-08-19 |
| Washington | Matt  |    12 | 2021-05-17 |
+------------+-------+-------+------------+
```

Relational Algebra Expression:

CLASS_STUDS← σ fname(Students, Borrows_Book)
Result←Π fname, lname, class (**CLASS_STUDS**)

List of Some SQL Queries and Output

Q6. Select lname,fname,issue date from Teacher and Borrows Book table where teacher 'fname' equals Borrows book 'fname

```
MariaDB [19647vk]> select t.lname,t.fname,t.class,bb.issue_date,bb.title from Teacher t,Borrows_Newspaper_Journal bb  where t.fname=bb.fname;
+-----------+--------+-------+------------+-----------+
| lname     | fname  | class | issue_date | title     |
+-----------+--------+-------+------------+-----------+
| Robertson | Jayson |    10 | 2021-01-22 | The Atlas |
+-----------+--------+-------+------------+-----------+
```

Relational Algebra Expression:

CLASS_TEACH← σ fname(Teachers, Borrows_Book)

Result←Π fname, lname, class (**CLASS_TEACH**)

List of Some SQL Queries and Output

Q7. Select lname,fname,issue date from Teacher and Borrows Electronic Assets table where teacher 'fname' equals Borrows Electronic Assets 'fname

```
MariaDB [19647vk]> select t.lname,t.fname,t.class,bb.issue_date,bb.file_name from Teacher t,Borrows_Electronic bb  where t.fname=bb.fname;
+---------+---------+-------+------------+------------------------+
| lname   | fname   | class | issue_date | file_name              |
+---------+---------+-------+------------+------------------------+
| Fetcher | Roland  |    12 | 2021-09-25 | History of Psycology   |
| Lawson  | Rebecca |    11 | 2021-02-22 | Managing Finance Economy |
+---------+---------+-------+------------+------------------------+
```

Relational Algebra Expression:

CLASS_TEACH← σ fname(Teachers, Borrows_Electronis Assets)
Result←Π fname, lname, class (**CLASS_TEACH**)

SQL Queries Right Outer Join

Q8.Select fname, lname, class, book_isbn, issue_date from Student right outer join Borrows book where student fname equals Borrows book fname and due date is greater than '2021-06-07'

```
MariaDB [19647vk]> select s.fname,s.lname,s.class,bb.book_isbn,bb.issue_date from Students s right outer join Borrows_Book bb ON  s.fname=bb.fname and bb.due
_date>'2021-06-07';
+-------+------------+-------+--------------------+------------+
| fname | lname      | class | book_isbn          | issue_date |
+-------+------------+-------+--------------------+------------+
| Kate  | MIller     |    12 | 978-1-933624-76-1  | 2021-06-23 |
| Jack  | Tisdel     |    11 | 978-1-62544-276-5  | 2021-08-19 |
| Matt  | Washington |    12 | 978-1-62544-177-5  | 2021-05-17 |
| NULL  | NULL       |  NULL | 978-0-9720295-3-7  | 2021-02-17 |
| NULL  | NULL       |  NULL | 978-1-6254416-167-6 | 2021-05-16 |
+-------+------------+-------+--------------------+------------+
```

Relational Algebra Expression:

BRR_FNAME ← Student ⋈ σfname=fname(Borrows_Books)

BKK_REC ← σ date >'2021-06-07'(Borrows_Books)

Result ← Π fname,lname,class,book_isbn,issue_date (BRR_FNAME ∪ BKK_REC)

SQL Queries Inner Join

Q9.Select fname, lname, class, book_isbn, issue_date from Student inner join Borrows book where student fname equals Borrows book fname and due date is greater than '2021-06-07'

```
MariaDB [19647vk]> select t.fname,t.lname,t.class,bb.book_isbn,bb.issue_date from Teacher t inner join Borrows_Book bb ON  t.fname=bb.fname and bb.due_date>'
2021-06-07';
+--------+----------+-------+------------------+------------+
| fname  | lname    | class | book_isbn        | issue_date |
+--------+----------+-------+------------------+------------+
| Jayson | Robertson |    10 | 978-0-9720295-3-7 | 2021-02-17 |
+--------+----------+-------+------------------+------------+
```

Relational Algebra Expression:

BRR_FNAME ← Student $\bowtie$ σfname=fname(Borrows_Books)

BKK_REC ← σ date >'2021-06-07'(Borrows_Books)

Result ← Π fname,lname,class,book_isbn,issue_date (BRR_FNAME ∪ BKK_REC)

SQL Queries Natural Join

Q10.Select fname, lname, class, book_isbn, issue_date from Teacher natural join Borrows book where teacher fname equals Borrows book fname and due date is greater than '2021-06-07

```
MariaDB [19647vk]> select b.title,b.author_name,b.category,bb.issue_date,bb.fname from Books b natural join Borrows_Book bb where b.isbn=bb.book_isbn and bb.
due_date>'2021-05-01';
+--------------------+-------------------+-----------------+------------+--------+
| title              | author_name       | category        | issue_date | fname  |
+--------------------+-------------------+-----------------+------------+--------+
| ABC Danny          | Martha Wesleysan  | Literature      | 2021-06-23 | Kate   |
| Alive or Not       | Matthew Larwson   | Fantasy         | 2021-05-17 | Matt   |
| All about Danny    | Felecia Payne     | Fantasy         | 2021-02-17 | Jayson |
| All about Danny Lap | Patrick Washington | Biography      | 2021-05-16 | Lawson |
| All my Friends     | Kethrine Peterson | Forklore&Fiction | 2021-08-19 | Jack   |
+--------------------+-------------------+-----------------+------------+--------+
```

Relational Algebra Expression:

BRR_FNAME←Teacher ⋈ σfname=fname(Borrows_Books)

BKK_REC← σ date >'2021-06-07'(Borrows_Books)

Result← Π fname,lname,class,book_isbn,issue_date (BRR_FNAME ∪ BKK_REC)

SQL Queries Three Way Join Right Outer

Q11. Select title, author name, category, issue date, fname from Books Natural join Borrows book where isbn equals book isbn and due date is greater than 2021-05-01

```
MariaDB [19647vk]> select b.book_isbn,b.issue_date,s.fname,s.lname,s.class from Students s  right outer join Borrows_Book b ON b.fname= s.fname inner join Bo
oks bb ON bb.isbn=b.book_isbn where b.due_date>'2020-05-09';
+--------------------+------------+-------+------------+-------+
| book_isbn          | issue_date | fname | lname      | class |
+--------------------+------------+-------+------------+-------+
| 978-1-933624-76-1  | 2021-06-23 | Kate  | MIller     |    12 |
| 978-1-62544-276-5  | 2021-08-19 | Jack  | Tisdel     |    11 |
| 978-1-62544-177-5  | 2021-05-17 | Matt  | Washington |    12 |
| 978-0-9720295-3-7  | 2021-02-17 | NULL  | NULL       |  NULL |
| 978-1-6254416-167-6 | 2021-05-16 | NULL  | NULL       |  NULL |
+--------------------+------------+-------+------------+-------+
```

Relational Algebra Expression:

BRR_FNAME←Teacher ⋈ σfname=fname(Borrows_Books)

BKK_N_BRRK←Borrow_Books Books σisbn=book_isbn(Borrow_Books,Books)

BRR_FNM_N_BKK_BKK←(BRR_FNAME ∪ BKK_N_BRRK)

BKK_REC← σ date >'2021-06-07'(Students)

Result← Π book_isbn,issue_date,fname,lname,class (BRR_FNM_N_BKK_BKK ∪ BKK_REC)

CONCLUSION

With the help of Secondary School Library Management, schools can have an organized system which showcase various major entities present in a School Library System.

It keeps records of items borrowed from the Library which include:

- Students Information
- Teachers Information

It is mostly students and teachers who borrows book from Library and most often, students don’t return book after borrowing it but with the help of this system, a Library can have an accurate information of all students and teachers who borrowed books from the Library and by that, it will become much easier to make follow up on them for the return of items to the Library.

REFERENCES

- Fundamental of Database System 7th Edition. Elmasri Navathe
- Allen Beaulieu Learning 2nd Edition. Allen Beaulieu