Exercise 1
DSE 310

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Problem Introduction

For this exercise, I have picked a very crucial database for academics and students i.e **the library database management**. This is a quiet known example of real world database and I tried to map the **I I S E R Bhopal Library (Lumen) Database Management**. For better understanding, I have gone through some articles listed in the bibliography section, related to similar type of database management system. Though there is a major difference in the database system which I have explained in the next section. For taking our institute library as a target, this mapping can be used for any library at any research institute or universities.

Description of the Database

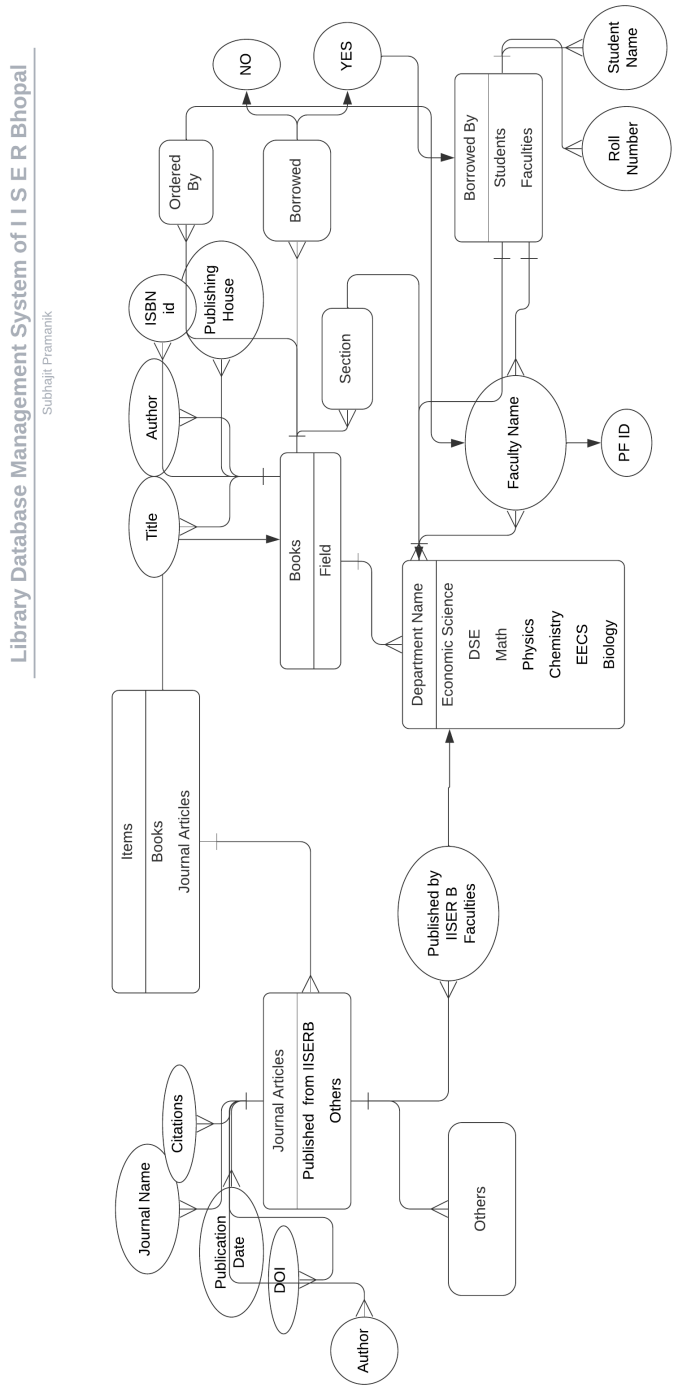
The main difference between I I S E R Bhopal Library and any regular library is that, institute library has also research article section, and a large number of article got published by the faculties and the students of the institute. The diagrammatic description of this mapping is available as the **ER Diagram** in the next section.

- At first, there are two types of items in the library, i.e: Books and Publications.
- Books are there as per department specific order.
- Every new book comes by some faculty's recommendation. That faculty list also lead the database to the department specific sorting.
- Publications can also be devided into two categories: (i) Published articles by faculties and (ii) other published articles.

- The faculties also can be sorted as per department specific so as the students also.
- There are identical number for everyone (Roll no for students and PF id for faculties).
- Journals has attributes like Title, Author name, Publication date, Journal name, DOI link.
- Books has the attributes like Title, Author name, Publication date, Publishing house, Edition.
- Books can be borrowed by both students and teachers. So, if teacher borrow, then the due date will be against the respective PF id and if a student borrow any book, then they'll be recorded against respective roll number.
- Except the department, there are other possible attributes or columns for the students and teachers (such as email id, phone number).

So, the above points briefly describes the database management we are trying to see here. This tells us how the database management mapping is, for the institute library. After this we will fix a relational problem to solve according to the entity relational model. So, for that I'm taking a entity relation that a student has borrowed a book from economic science section.

ER Diagram for the Database



Relational Algebra

So, for the problem we have taken a case where **a student is borrowing a book from economic science section**. Following the usual nomenclature, the relational algebric model look like:
$\sigma_{borrowed=yes,borrower=student,section=economicscience}(r)$

Relational Calculus

If b represents the borrowed book where $b \in B$ (B is the total set of book in the economic science section in the library). Then the relational calculus form the solutions are as follows:

Tuple Calculus

$\{\text{b } | b \in B, borrower = student\}$

Domain Calculus

Now if $b_1, b_2, ..., b_n$ are the books in the set b i.e. which are available for borrowing from the economic science section, then the attribute domain relational calculus solution form is as follows:

$\{\langle b_1, b_2, ..., b_n\rangle | \langle b_1, b_2, ..., b_n\rangle \in B, borrower = student\}$

References

- a P, Shanmugam A, Ramalakshmi Ganeshan, Sasthri S, Baalachandran. (2020). Library Management System. Xi'an Jianzhu Keji Daxue Xuebao/Journal of Xi'an University of Architecture Technology. 12. 743-753. 10.37896/JXAT12.11/29777.
- Aloia, Nicola Concordia, Cesare Meghini, Carlo. (2007). Implementing BRICKS, a Digital Library Management System.. 4-15.

Library Database Management System of I I S E R Bhopal

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