Project Deliverable 1

Outline

To analyze, design and implement a database system application for a *City Library*. As part of Project Deliverable 1, we have designed an *Extended Entity-Relationship(ER)* diagram that focuses on the same aspect.

Goal

We aim to produce an ER diagram such that it captures every possible DB specification correctly and will help further in actual physical implementation of the database. Also, we target to list every possible structural constraint on the diagram.

In this project, we demonstrate *how various entities in our mini-world named City Library are related to each other* and *how they form an integral part of the City Library*.

Assumptions

We have made following assumptions as we made progressed forward through this project:

1. Every Branch stores at least one copy of a document, for it to be a Library.
2. Every Document has at least one copy which is stored in at least one of the Library's Branches.
3. Every Document of type Book can have multiple Authors and the same Author can write multiple Books.
4. All data related to a single person is present in an entity type Person. The Person can be any one of the following category:
    a. An Author of a Book
    b. A Chief Editor of a Journal Volume.
    c. A Guest Editor Journal Issue
    d. A member of proceeding chairs in the Conference Proceedings
5. A User can borrow multiple copies of the same document.
6. A User can borrow from any Branch of the Library.

Constraints

After reviewing the specified documentation ,a.k.a, the project description on *City Library*, we have placed the below structural constraints:

Cardinality Ratios:

1. Every Volume must have at least one issue.
2. Each Journals Volume must have exactly one Chief Editor
3. A Conference Proceeding must have at least one Proceeding chair
4. A Book must have at least one Author
5. A Person can be an author of many books, editor of many JournalVolume / Issues or ProceedingChair of many Conferences.

Key Constraints:

1. Issues is a weak entity type in identifying relation with owner Journal Volume and uses ‘Did’ and its partial key (IssueNo) as its key.
2. Entity Copy is a weak entity type, which has one entry for every unique copy of a particular document belonging to a specific branch. It uses a combination of keys Bid (key of Branches) and Did(key of Documents) and its partial key(CopyNo) as its key.
3. CopyNo is a partial key of Copy which represents the Copy number of a particular document in a specific branch.
4. RTransaction and BTransaction are taken as different entity types because they have a diff key : RNum and BNum respectively.
5. Borrow Transaction Details is an entity type which records information about BDatetime and RDatetime for every copy borrowed in a particular transaction. It is related to ‘Copy’ by the relation ‘InfoOf’ to link BDateTime and RDateTime to the specific ‘Copy’ Information. It uses Bnum(key of BTransaction) and its partial key(BDatetime) as its key.

Challenges Faced:

We have faced several challenges in order to draw out abstractions of the City Library using Entity Relationship Diagrams. Some of them are as follows:

1. Relating various entities in the City Library such as, *Branch, Documents* and *Copies* of Documents,etc., in an abstract manner.
2. Representation of a Person entity who is related to various other entities of Documents in the database, each in a different way.
3. How Users can perform various transactions on various Copies of various Books.

4. How one can record these transactions and take all possible scenarios that are possible to happen.
    a. At first, we faced challenges in abstracting out a way to record multiple book transactions using a single *Bnum*. But as we progressed, we choose to design this using *BTransaction, BorrowTransDetails* to record multiple borrow transactions by a User.
    b. We also faced difficulties in identifying the relationship between *Users* entity to various transactions(such as *BTransaction and RTransactions*) on *Copies of Document* in an abstract manner.

ER Diagram (for a City Library System):