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Database Management for Chicago Public Library system

Chicago Public library is an enormous collection of books and it is the responsibility of any librarian to manage the record details of books that are published to the public and returned to the librarian. From this project we can obtain the entire data sheet of the particular library scheme to assist the library employees keep each book detail in order to prevent any other missing records. The first step to estimate the no.of tables required in their database (books, customers, staffs etc.) after the normalization, the tables need to be split and arranged for simple access accordingly. Then we can create/initialize the database, update, delete or insert it.

The main purpose of the project is to analyze the tables and create an E-R[model] diagram to create a database that the programmers and authorized users can easily use.

Normalization:

NormalForm	Characteristic
FirstNormalForm(1NF)	Eliminating the Repeating Groups, Identify the Primary Key, Identify All Dependencies
SecondNormalForm(2NF)	1NF and no partial dependencies
ThirdNormalForm(3NF)	2NF and no transitive dependencies

Normalization is the process for evaluating and correcting table structures to minimize data redundancies and data anomalies.

Normalization of the library database management system:

It includes the following information:

Uniquely identifies the member: **MembID**

Name of the member: **MembName**

Contact information of the member: **MembEmail**

Number of books taken by the member: **NoOfBksIssued**

No.of Books returned by the member: **NoOfBksReturned**

Date on which member received the book: **IssDate**

Date on which member must return the book: **DueDate**

Fine charges for the late return: **MembFine**

Holding the book: **BkHold**

Uniquely identifies the book: **BkID**

Name of the book: **BkName**

Name of the author: **BkAuthor**

Number of books available: **BksAvailable**

Uniquely identifies the Librarian: **LibrarianID**

Name of the librarian: **LibrarianName**

Contact information of the librarian: **LibrarianPhoneNo**

Uniquely identifies the department: **DeptID**

Name of the department: **DeptName**

Uniquely identifies the library card: **CardNo**

Expiration date of the card: **CardExpiry**

1NF:

- Identify the Primary Key
- Identify All Dependencies

MembID	MembName	MembEmail	NoOfBksIssued	NoOfBksReturned	IssDate	DueDate	MembFine	BkID	BkName	BkAuthor	BksAvailable	BkHold	LibrarianID	LibrarianName	LibrarianPhoneNo	DeptID	DeptName	CardNo	CardExpiry

1st step in normalization is to identify the primary keys:

Primary Keys: MembID, BkID

(**MembID**, **BkID**) - MembName, MembEmail, NoOfBksIssued, NoOfBksReturned, IssDate, DueDate, BkName, BkAuthor, BksAvailable, BkHold, MembFine, LibrarianID, LibrarianName, LibrarianPhoneNo, DeptID, DeptName, CardNo, CardExpiry

2nd step in normalization is to identify both the partial and transitive dependencies:

The Partial Dependencies are

MembID: MembName, MembEmail, NoOfBksIssued, NoOfBksReturned, DeptID, DeptName, CardNo, CardExpiry, MembFine

BkID: BkName, BkAuthor, BksAvailable, BkHold, LibrarianID, LibrarianName, LibrarianPhoneNo

The transitive dependencies are

LibrarianID: LibrarianName, LibrarianPhoneNo

CardNo: CardExpiry

DeptID: DeptName

2NF:

It is in 1NF and

It includes no partial dependencies

After removing partial dependencies, we have the following tables

A	B	C	D
MembID	BkID	IssDate	DueDate

A	B	C	D	E	F	G	H	I	J
MembID	MembName	MembEmail	MembFine	NoOfBksIssued	NoOfBksReturned	DeptID	DeptName	CardNo	CardExpiry

A	B	C	D	E	F	G	H
BkID	BkName	BkAuthor	BksAvailable	BkHold	LibrarianID	LibrarianName	LibrarianPhoneNo

Primary Keys: MembID, BkID

Transitive dependencies:

LibrarianID: LibrarianName, LibrarianPhoneNo

CardNo: CardExpiry

DeptID: DeptName

3NF:

It is in 2NF and transitive dependencies must be removed.

After removing the transitive dependencies, we have the following tables

A	B	C	D
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Issue Entity

MembID	BkID	IssDate	DueDate

A	B	C	D	E	F	G	H
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Member Entity

MembID	MembName	MembEmail	MembFine	NoOfBksIssued	NoOfBksReturned	DeptID	CardNo

A	B	C	D	E	F
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Book Entity

BkID	BkName	BkAuthor	BksAvailable	BkHold	LibrarianID

A	B	C
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Librarian entity

LibrarianID	LibrarianName	LibrarianPhoneNo



Card entity

CardNo	CardExpiry



Department Entity

DeptID	DeptName

Primary Keys: MembID, BkID, LibrarianID, CardNo, DeptID

After 3NF we have the six tables.

Overall classification of tables after 3NF

PK: Primary key

FK: Foreign key

Member Entity

ATTRIBUTES	DATA TYPE	KEY ATTRIBUTE
MembID	int	PK: <u>MembID</u>
MembName	varchar	FK: DeptID
MembEmail	nvarchar	FK: CardNo
NoOfBksIssued	int	
NoOfBksReturned	int	
DeptID	int	
MembFine	Int	
CardNo	int	

Member entity includes the information about member details, number of books received and returned by the member along with the department ID and the library card number and fine details if any book was returned late.

Book Entity

ATTRIBUTES	DATA TYPE	KEY ATTRIBUTE
BkID	int	PK: <u>BkID</u>
BkName	varchar	FK: LibrarianID
BkAuthor	varchar	
BksAvailable	int	
BkHold	int	
LibrarianID	Int	

Book entity includes all the details about the books and the librarian Id who issued the books.

Issue Entity

ATTRIBUTES	DATA TYPE	KEY ATTRIBUTE
MembID BkID IssDate DueDate	int int Datetime Datetime	PK: <u>MembID</u>

Issue table includes the information about the issued date and return date of the books which has been issued to the member.

Department Entity

ATTRIBUTES	DATA TYPE	KEY ATTRIBUTE
DeptID DeptName	int varchar	PK: <u>DeptID</u>

The department table includes the department ID and department name of the member.

Librarian Entity

ATTRIBUTES	DATA TYPE	KEY ATTRIBUTE
LibrarianID LibrarianName LibrarianPhoneNo	int varchar int	PK: <u>LibrarianID</u>

Librarian entity includes the information about the Librarian who issue the books and their contact information.

Card Entity

ATTRIBUTES	DATA TYPE	KEY ATTRIBUTE
CardNo CardExpiry	int Datetime	PK: <u>CardNo</u>

Card table includes information about the library card, each member can have more than one library card and a maximum of three cards.

ER_Diagram of Library System:

The E-R model is intended primarily for the database-design process. It was developed to facilitate database design by allowing the specification of an enterprise schema. Such a schema represents the overall logical structure of the database. This overall structure can be expressed graphically by an E-R diagram.

An entity is an object that exists in the real world and is distinguishable from other objects. We express the distinction by associating with each entity a set of attributes that describes the object.

A relationship is an association among several entities. A relationship set is a collection of relationships of the same type, and an entity set is a collection of entities of the same type.

