

# Database For A Library Management System

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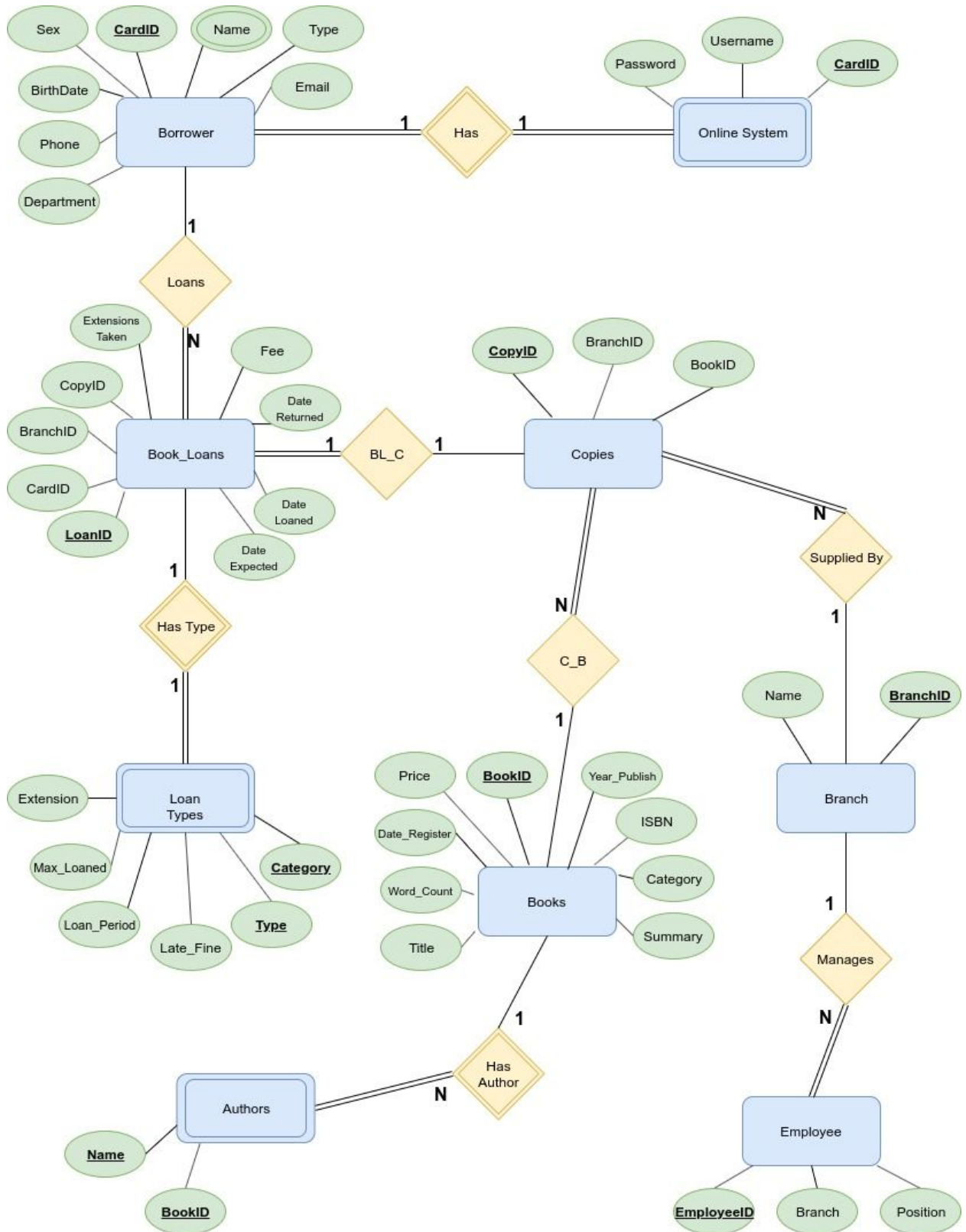
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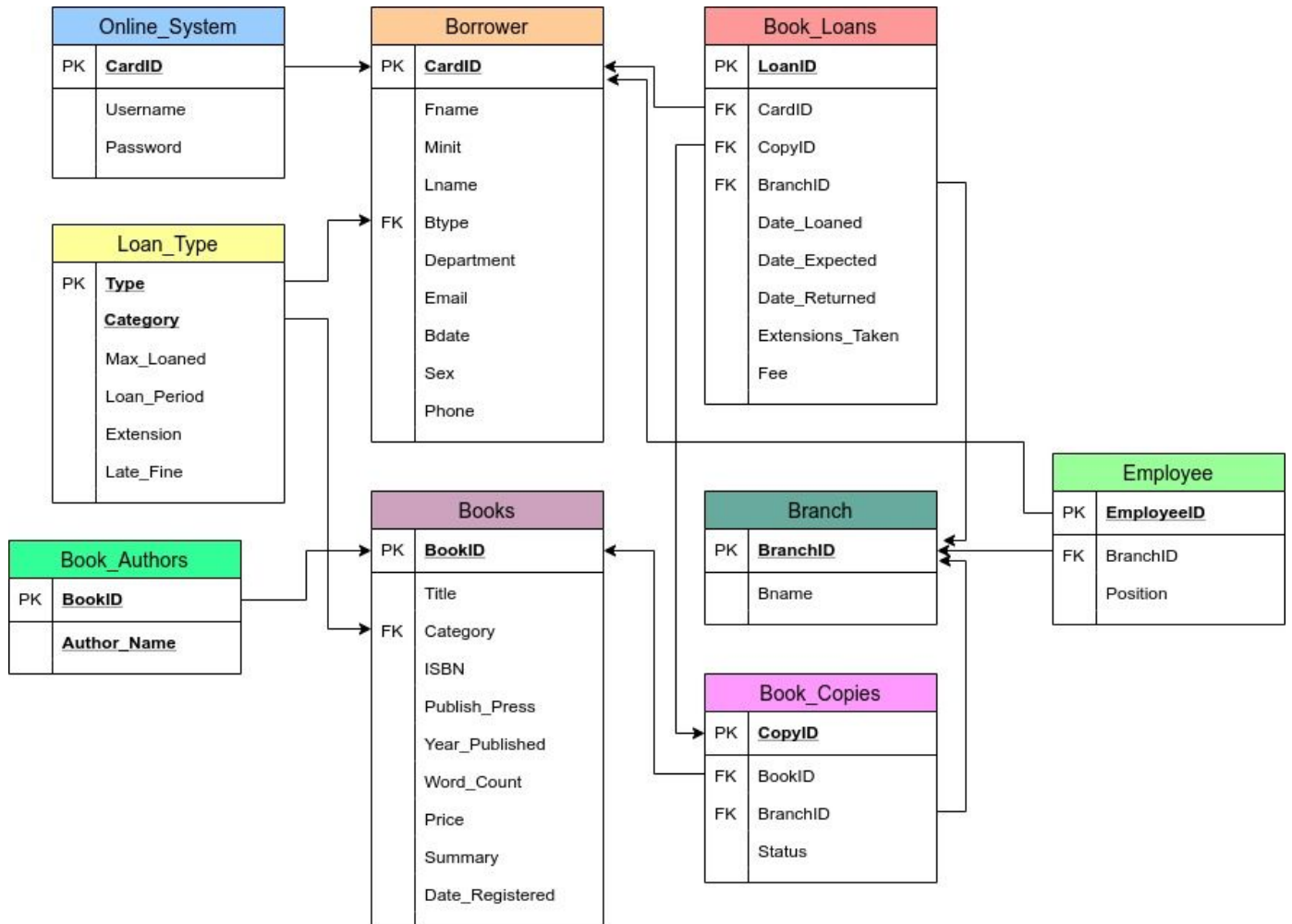
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## Conceptual Modeling Using ER Model



## Relational Schema



## Table Constraints

Borrower	
Fname	Not Null
Minit	
Lname	Not Null
CardID	Primary Key
Btype	Foreign Key, Not Null
Department	Not Null
Email	Not Null
Sex	
Bdate	Not Null
Phone	

Loan_Type	
Type	Primary Key(Type,Category)
Category	
Max_Loaned	Not Null
Loan_Period	Not Null
Extension	Not Null
Late_Fine	Not Null

Branch	
BranchID	Primary Key
Bname	Not Null, Unique

Book_Authors	
BookID	Primary Key(BookID,Authory_Name)
Author_Name	

Book_Loans	
LoanID	Primary Key
CardID	Foreign Key, Not Null
CopyID	Foreign Key, Not Null
BranchID	Foreign Key, Not Null
Date_Loaned	Not Null
Date_Expected	Not Null
Date_Returned	
Extensions_Taken	Not Null
Fee	Not Null, Default 0.00

Book_Copies	
CopyID	Primary Key
BookID	Foreign Key,Not Null
BranchID	Foreign Key,Not Null
Status	Not Null

Employee	
EmployeeID	Primary Key
BranchID	Foreign Key, Not Null
Position	

Books	
BookID	Primary Key
Title	Foreign Key, Not Null
Category	Foreign Key, Not Null
Isbn	Not Null, Unique
Publish_Press	
Year_Publish	
Word_Count	
Summary	
Date_Registered	Not Null

Online_System	
CardID	Primary Key
Username	Not Null
Password	Not Null

## Database Initial State

### Borrower

	Fname	Minit	Lname	CardID	Btype	Department	Email	Sex	Bdate	Phone
▶	Jessica	L	Facht	0000000	Graduate Student	Finance	jlf@gmail.com	F	1995-09-05	7878541259
	Thomas	L	Newer	0000001	Faculty	Electrical Engineering	tlm@gmail.com	M	1965-06-01	1564526385
	Richard	W	Toyer	0000002	Vocational Student	Finance	rwt@gmail.com	M	1978-01-12	0059473625
	Samantha	P	Garcia	0000003	Undergraduate Student	Finance	spg@gmail.com	F	1989-12-13	2534555524
	Sophia	B	Berard	0000004	Graduate Student	Finance	sbb@gmail.com	F	1967-12-09	7777774635
	Sheree	K	Bankler	0000005	Graduate Student	Computer Science	skb@gmail.com	F	1976-11-05	1048372645
	Pasindu	L	Siri	0000006	Graduate Student	Computer Science	pls@gmail.com	M	1996-11-05	1049072645
	John	L	Smith	1111111	Faculty	Electrical Engineering	jls@gmail.com	M	1965-12-08	3109873425
	Joana	Q	Garcia	1212121	Staff	Finance	jgq@gmail.com	F	1989-09-14	3696369636
	Maddeline	T	Black	1234567	Faculty	Computer Science	mtb@gmail.com	F	1996-08-19	3365289658
	Sam	R	Westner	2222222	Faculty	Electrical Engineering	srw@gmail.com	M	1998-01-01	1896325874
	Zachary	J	Perry	3333333	Undergraduate Student	Electrical Engineering	zjp@gmail.com	M	1987-02-05	3946751248
	Oscar	M	Polonco	4444444	Vocational Student	Electrical Engineering	omp@gmail.com	M	1985-03-09	1234996525
	Brenda	E	Wo	4545454	Staff	Finance	bew@gmail.com	F	1988-11-02	4565456321
	Joshua	W	Talter	5555555	Staff	Electrical Engineering	jwv@gmail.com	M	1995-04-10	3325652548
	Darline	J	Dasini	7654321	Graduate Student	Computer Science	djd@gmail.com	F	1997-08-23	1313125632
	Rebecca	C	Taylor	9999999	Undergraduate Student	Computer Science	rct@gmail.com	F	1996-07-17	1325698569
•	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL

### Book\_Loans

	LoanID	CardID	CopyID	BranchID	Date_Logged	Date_Expected	Date_Returned	Extensions_Taken	Fee
▶	100	0000002	5678	2	2019-10-15	2019-12-29	NULL	1	0.00
	111	1234567	2222	2	2019-08-24	2019-10-23	NULL	0	0.00
	123	1111111	1111	1	2019-06-14	2019-08-13	2019-11-16	0	47.50
	134	4545454	1058	3	2019-11-15	2020-02-13	2019-12-01	1	0.00
	185	7654321	9999	2	2019-10-27	2020-01-25	NULL	1	0.00
	200	0000002	0002	2	2019-09-23	2019-11-22	2019-12-03	0	2.20
	222	3333333	0890	2	2019-11-25	2020-01-24	2019-11-20	0	0.00
	264	1212121	3243	1	2019-11-15	2019-11-22	NULL	0	5.50
	300	0000003	0003	2	2019-10-26	2020-01-24	NULL	1	0.00
	400	0000001	0004	3	2019-07-28	2019-10-26	2019-12-03	0	7.60
	444	0000000	1234	1	2019-10-17	2020-01-15	2019-10-25	1	0.00
	456	2222222	7777	1	2019-10-23	2020-02-20	NULL	1	0.00
	500	0000005	6666	3	2019-10-31	2019-12-30	NULL	0	0.00
	789	3333333	3333	3	2019-11-25	2019-12-02	2019-11-24	0	0.00
	958	5555555	1946	1	2019-11-11	2020-02-09	NULL	1	0.00
	999	9999999	1010	3	2019-06-18	2019-08-17	NULL	0	54.00
•	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL

### Online\_System

	CardID	Username	Password
▶	0000000	0000000	09051995
	0000001	0000001	06011965
	0000002	0000002	01121978
	0000003	0000003	12131989
	0000004	0000004	12091967
	0000005	0000005	11051976
	0000006	0000006	11051996
	1111111	1111111	12081965
	1212121	1212121	09141989
	1234567	1234567	08191996
	2222222	2222222	01011998
	3333333	3333333	02051987
	4444444	4444444	03091985
	4545454	4545454	11021988
	5555555	5555555	04101995
	7654321	7654321	08231997
	9999999	9999999	07171996
•	NULL	NULL	NULL



## Employee

	EmployeeID	BranchID	Position
▶	1212121	2	Manager
	4545454	1	Manager
	5555555	3	Manager
*	NULL	NULL	NULL

## Branch

	BranchID	Bname
▶	1	Branch A
	2	Branch B
	3	Branch C
*	NULL	NULL

## Book\_Authors

	BookID	Author_Name
▶	000100	Jack Weiss
	000200	Bob Washington
	000258	Gale Lackman
	111122	Bob Washington
	123456	Jack Weiss
	123456	Sarah Cardington
	185526	Sasha Brown
	785825	Phil Spencer
	785825	Sasha Brown
	789456	Alexandria Cortez
	999636	Mark Rackner
*	NULL	NULL

## Books

	BookID	Title	Category	Isbn	Publish_Press	Year_Published	Word_Count	Price	Summary	Date_Registered
▶	000100	Learn Money	English	577-7-3424-4444-4	Dasi Press	2013	56367	45.00	Learn how to use money and control the markets	2014-03-14
	000200	The Basics of Everything	English	677-7-0948-4444-4	Penguin Press	2005	34367	25.00	Learning the basics of everything on this planet	2009-07-09
	000258	OOP Design	English	333-3-3333-6666-6	The Coders	2017	20563	35.00	Learn Object Oriented Programming in Java	2008-08-19
	000300	Master Physics	English	677-7-4625-4444-4	Smart Press	2005	34367	25.00	Learning Physics	2017-04-09
	111122	Book of Law	English	963-9-6396-3963-9	Dasi Press	1999	28987	100.99	Becoming the ultimate lawyer has never been so ...	2011-02-18
	123456	Learn Python 101	English	123-6-5478-9632-5	The Coders	2005	18325	63.25	Become a beginner to master in Python	2008-04-18
	185526	Mastering Statistics	New	111-1-1111-1111-1	Penguin Press	2003	10258	63.25	This book makes statistics fun to learn	2019-11-17
	785825	Data Science	English	232-3-2323-2323-2	The Coders	2013	12354	20.00	Learn everything that is needed for a Data Scie...	2010-12-23
	789456	The Court	English	777-7-7777-4444-4	Dasi Press	2002	25367	78.32	Adapt to the situations in a court room with this...	2003-01-16
	999636	El Negocio	Foreign	222-2-8888-2222-8	Penguin Press	2016	11256	59.99	Learn to be a hispanic business entrepreneur	2017-06-04
*	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL

## Loan\_Type

	Type	Category	Max_Loaned	Loan_period	Extension	Late_Fine
▶	Faculty	English	12	90	30	0.20
	Faculty	Foreign	3	60	30	0.50
	Faculty	New	1	7	0	0.50
	Graduate Student	English	12	60	30	0.20
	Graduate Student	Foreign	3	60	30	0.50
	Graduate Student	New	1	7	0	0.50
	Staff	English	7	60	30	0.20
	Staff	Foreign	1	30	30	0.50
	Staff	New	1	7	0	0.50
	Undergraduate Student	English	8	60	30	0.20
	Undergraduate Student	Foreign	2	60	30	0.50
	Undergraduate Student	New	1	7	0	0.50
	Vocational Student	English	5	60	15	0.20
	Vocational Student	Foreign	1	30	15	0.50
	Vocational Student	New	1	7	0	0.50
*	NULL	NULL	NULL	NULL	NULL	NULL

## Book\_Copies

	CopyID	BookID	BranchID	Status
▶	0001	000100	2	Available
	0002	000100	2	Available
	0003	000100	2	Lent Out
	0004	000200	3	Available
	0005	000200	1	Available
	0006	000200	2	Available
	0007	000300	2	Available
	0890	000258	2	Available
	1010	999636	3	Lent Out
	1058	123456	3	Available
	1111	999636	1	Available
	1212	999636	1	Available
	1234	789456	1	Available
	1946	785825	1	Lent Out
	2222	999636	2	Lent Out
	2534	785825	3	Available
	3243	185526	1	Lent Out
	3333	185526	3	Available
	3526	123456	3	Available
	4444	185526	1	Available
	5555	123456	3	Available
	5678	111122	2	Lent Out
	6666	123456	3	Lent Out
	7777	785825	1	Lent Out
	8888	785825	3	Available
	9999	000258	2	Lent Out
*	NULL	NULL	NULL	NULL

## Database Procedures

**Borrow** - Gathers loan information and inserts into *Book\_Loans* table.

```
DELIMITER //
CREATE PROCEDURE Borrow(IN Loan char(3),IN memberID char(7), IN Copy char(4), In date_borrowed date)
BEGIN
    Select Category Into @category From Books Where BookID IN(Select BookID From Book_Copies Where CopyID = Copy) Limit 1;
    Select Btype Into @type From Borrower Where CardID = memberID Limit 1;
    Select BranchID Into @branch From Book_Copies Where CopyID = Copy;
    Select Late_Fine,Loan_Period Into @fine,@period From Loan_Type Where Type = @type And Category = @category;

    Set @dateExpected = Date_add(date_borrowed, Interval @period Day);
    Set @daysSinceExpected = datediff(CURDATE(),@dateExpected);
    Set @fee = 0.00;

    If @daysSinceExpected > @period Then
        Set @fee = @daysSinceExpected * @fine;
    End If;

    Insert Into Book_Loans(LoanID,CardID,CopyID,BranchID,Date_Logged,Date_Expected,Date_Returned,Extensions_Taken,Fee)
    Values(Loan,memberID,Copy,@branch,date_borrowed,@dateExpected,NULL,0,@fee);
END //
DELIMITER ;
```

**Renewal** - Gathers loan information and updates *Book\_Loans* table.

```
DELIMITER //
CREATE PROCEDURE Renewal(IN Loan char(3))
BEGIN
    Select Category Into @category From Books Where BookID In(Select BookID From Book_Copies Where CopyID In(Select CopyID From Book_Loans Where LoanID = Loan));
    Select Btype Into @type From Borrower Where CardID In (Select CardID From Book_Loans Where LoanID = Loan);
    Select Date_Expected Into @expected From Book_Loans Where LoanID = Loan;
    Select Late_Fine,Loan_Period,Extension Into @fine,@period,@renewperiod From Loan_Type Where Type = @type And Category = @category;

    Set @newExpected = Date_add(@expected, Interval @renewperiod Day);
    Set @daysSinceExpected = datediff(CURDATE(),@newExpected);
    Set @fee = 0.00;

    If @daysSinceExpected > @period Then
        Set @fee = @daysSinceExpected * @fine;
    End If;

    Update Book_Loans Set Date_Expected = @newExpected, Extensions_Taken = Extensions_Taken+1, Fee = @fee Where LoanID = Loan;
END //
DELIMITER ;
```



## **ReturnBook** - Gathers loan information and updates *Book\_Loans* table

```
DELIMITER //
CREATE PROCEDURE ReturnBook(IN Loan char(3), IN Branch int, IN Rdate date)
BEGIN
    Select Category Into @category From Books Where BookID In(Select BookID From Book_Copies Where CopyID In(Select CopyID From Book_Loans Where LoanID = Loan));
    Select Btype Into @type From Borrower Where CardID In (Select CardID From Book_Loans Where LoanID = Loan);
    Select Date_Expected Into @expected From Book_Loans Where LoanID = Loan;
    Select Late_Fine,Loan_Period Into @fine,@period From Loan_Type Where Type = @type And Category = @category;
    Set @daysSinceExpected = datediff(Rdate,@expected);
    Set @fee = 0.00;

    If @daysSinceExpected > @period Then
        Set @fee = ABS(@daysSinceExpected) * @fine;
    End If;

    Update Book_Loans Set Date_Returned = Rdate, Fee = @fee, BranchID = Branch Where LoanID = Loan;
END //
DELIMITER ;
```

## **Inquiry\_Borrower** - Prints out information on borrower's loaned books

```
DELIMITER //
CREATE PROCEDURE Inquiry_Borrower(IN Card char(7))
BEGIN
    Select * From Book_Loans Where CardID = Card;
END //
DELIMITER ;
```

## **Inquiry\_Officer** - Prints all book information and borrower information

```
DELIMITER //
CREATE PROCEDURE Inquiry_Officer(IN Card char(7), IN Book char(6))
BEGIN
    If Card Is Not Null Then
        Select * From Borrower Where CardID = Card;
        Select * From Book_Loans Where CardID = Card;
    End If;

    If Book Is Not Null Then
        Select * From Books Where BookID = Book;
        Select * From Book_Copies Where BookID = Book;
    End If;
END //
DELIMITER ;
```

## Database Triggers

### **Create\_online\_acct** - After Insert on *Borrower*

- After inserting a Borrower, Create an online account for the borrower.
  - Set the username as the **CardID**
  - Set the password as the password

### **Check\_new\_book** - Before Insert on *Books*

- Before inserting a Book, Check the date difference between the current date and the **Date\_Registered** is < 60 .
  - If it is, Set the **Category** = “New”

### **Check\_before\_borrowing** - Before Insert on *Book\_Loans*

- Checks to see if the Book is still “New”
  - If it is, Set the **Category** = “English” or “Foreign”
- Checks to see if the borrower has **Fees** that are unpaid or an overdue book
  - If true, then reject loan
    - Call Borrow("010","0000002","1234",curdate());
- Checks to see if the borrower has reached their maximum book limit based on their borrower **Type** and book **Category**
  - If true, then reject loan

### **Create\_before\_returning\_and\_renewal** - Before Update on *Book\_Loans*

- Checks to see if borrower has overdue books before renewal
  - If true, then reject renewal
    - Call Renewal("264");
- Checks to see if borrower has already reached maximum **Extensions\_Taken** before renewal
  - If true, then reject renewal
    - Call Renewal("100");
- Checks to see if the book Category is “New” before renewal
  - If true, the reject renewal
- Checks to see if borrower returned the book at the same branch it was borrowed before return
  - If true, then reject return
- Checks to see if borrower returned the book on the same day it was borrowed before return
  - If true, then reject return

***action\_after\_returning*** - After Update on *Book\_Loans*

- After returning, set the **Status** of the book borrowed to “Available”

***Set\_book\_lent\_out*** - After Insert on *Book\_Loans*

- After loaned, set the **Status** of the book borrowed to “Lent Out”