

# CSE 4701 — Project 1, Part 1

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## Generating the Database Schema

The following SQL commands were used to generate the 'Book.Loan.DB' database schema.

```
01 | CREATE TABLE Book (
02 |     Book_id VARCHAR(2) NOT NULL,
03 |     Title VARCHAR(255) NOT NULL,
04 |     Publisher_name VARCHAR(255) NOT NULL,
05 |     PRIMARY KEY (Book_id)
06 | );
07 |
08 | CREATE TABLE Book_Authors (
09 |     Book_id VARCHAR(2) NOT NULL,
10 |     Author_name VARCHAR(255) NOT NULL,
11 |     PRIMARY KEY (Book_id, Author_name),
12 |     FOREIGN KEY (Book_id) REFERENCES Book(Book_id)
13 | );
14 |
15 | CREATE TABLE Publisher (
16 |     `Name` VARCHAR(255) NOT NULL,
17 |     `Address` VARCHAR(255) NOT NULL,
18 |     Phone VARCHAR(14) NOT NULL,
19 |     PRIMARY KEY (`Name`, `Address`)
20 | );
21 |
22 | CREATE TABLE Book_Copies (
23 |     Book_id VARCHAR(2) NOT NULL,
24 |     Branch_id VARCHAR(3) NOT NULL,
25 |     No_of_copies INT NOT NULL,
26 |     PRIMARY KEY (Book_id),
27 |     FOREIGN KEY (Book_id) REFERENCES Book(Book_id)
28 | );
29 |
30 | CREATE TABLE Library_Branch (
31 |     Branch_id VARCHAR(3) NOT NULL,
32 |     Branch_name VARCHAR(255) NOT NULL,
33 |     `Address` VARCHAR(255) NOT NULL,
34 |     PRIMARY KEY (Branch_id)
35 | );
36 |
37 | CREATE TABLE Borrower (
38 |     Card_no VARCHAR(2) NOT NULL,
39 |     `Name` VARCHAR(255) NOT NULL,
40 |     `Address` VARCHAR(255) NOT NULL,
41 |     Phone VARCHAR(14) NOT NULL,
42 |     PRIMARY KEY (Card_no)
43 | );
44 |
45 | CREATE TABLE Book_Loans (
46 |     Book_id VARCHAR(2) NOT NULL,
47 |     Branch_id VARCHAR(3) NOT NULL,
48 |     Card_no VARCHAR(2) NOT NULL,
49 |     Date_out DATE NOT NULL,
50 |     Due_date DATE NOT NULL,
51 |     PRIMARY KEY (Book_id, Branch_id, Card_no),
52 |     FOREIGN KEY (Book_id) REFERENCES Book(Book_id),
53 |     FOREIGN KEY (Branch_id) REFERENCES Library_Branch(Branch_id),
54 |     FOREIGN KEY (Card_no) REFERENCES Borrower(Card_no)
55 | );
```

## Populating the Database

The following SQL commands were used to populate the 'Book\_Loan\_DB' database.

```
01 | INSERT INTO Book (Book_id, Title, Publisher_name) VALUES ('B1', 'The Lost Tribe', 'Picador');
02 | INSERT INTO Book (Book_id, Title, Publisher_name) VALUES ('B2', 'It', 'Simon & Schuster');
03 | INSERT INTO Book (Book_id, Title, Publisher_name) VALUES ('B3', 'Event Horizon', 'Tom Doherty
    ↳ Assoc Llc');
04 |
05 | INSERT INTO Book_Authors (Book_id, Author_name) VALUES ('B1', 'Mark Lee');
06 | INSERT INTO Book_Authors (Book_id, Author_name) VALUES ('B2', 'Stephen King');
07 | INSERT INTO Book_Authors (Book_id, Author_name) VALUES ('B3', 'Steven McDonald');
08 |
09 | INSERT INTO Publisher (`Name`, `Address`, Phone) VALUES ('Picador', '4300 Turkey Pen Road', '
    ↳ (223) 444-5521');
10 | INSERT INTO Publisher (`Name`, `Address`, Phone) VALUES ('Simon & Schuster', '4096 Emerson Road'
    ↳ , '(421) 540-1675');
11 | INSERT INTO Publisher (`Name`, `Address`, Phone) VALUES ('Tom Doherty Assoc Llc', '4321 Walnut
    ↳ Hill Drive', '(345) 623-0356');
12 |
13 | INSERT INTO Book_Copies (Book_id, Branch_id, No_of_copies) VALUES ('B1', 'BR1', 15);
14 | INSERT INTO Book_Copies (Book_id, Branch_id, No_of_copies) VALUES ('B2', 'BR2', 10);
15 | INSERT INTO Book_Copies (Book_id, Branch_id, No_of_copies) VALUES ('B3', 'BR3', 20);
16 |
17 | INSERT INTO Library_Branch (Branch_id, Branch_name, `Address`) VALUES ('BR1', 'Sharpstown', '9
    ↳ Bow Ridge Street Sharpstown');
18 | INSERT INTO Library_Branch (Branch_id, Branch_name, `Address`) VALUES ('BR2', 'Beloit', '3 West
    ↳ Rd. Beloit');
19 | INSERT INTO Library_Branch (Branch_id, Branch_name, `Address`) VALUES ('BR3', 'Drive Lake
    ↳ Charles', '824 Rock Maple Drive Lake Charles');
20 |
21 | INSERT INTO Borrower (Card_no, `Name`, `Address`, Phone) VALUES ('C1', 'John Smith', '731
    ↳ Fondren, Houston, TX', '(206) 342-8631');
22 | INSERT INTO Borrower (Card_no, `Name`, `Address`, Phone) VALUES ('C2', 'Franklin Wong', '638
    ↳ Voss, Houston, TX', '(717) 550-1675');
23 | INSERT INTO Borrower (Card_no, `Name`, `Address`, Phone) VALUES ('C3', 'Alicia Zelaya', '3321
    ↳ Castle, Spring, TX', '(248) 762-0356');
24 |
25 | INSERT INTO Book_Loans (Book_id, Branch_id, Card_no, Date_out, Due_date) VALUES ('B1', 'BR1', '
    ↳ C1', '2023-01-05', '2023-02-05');
26 | INSERT INTO Book_Loans (Book_id, Branch_id, Card_no, Date_out, Due_date) VALUES ('B2', 'BR2', '
    ↳ C2', '2022-12-06', '2023-01-06');
27 | INSERT INTO Book_Loans (Book_id, Branch_id, Card_no, Date_out, Due_date) VALUES ('B3', 'BR3', '
    ↳ C2', '2023-01-29', '2023-03-01');
```

## Verifying Table Constraints

Below is the TABLE.CONSTRAINTS system table located in the ‘information\_schema’ database. This table contains information about the constraints on tables in the database.

You can see below that the ‘Book\_Loan\_DB’ table schema contains constraints for all of the foreign keys defined in the various tables in the database. In this way, we can verify that the foreign keys are defined correctly.

```

MariaDB [Book_Loan_DB]> SELECT * FROM information_schema.TABLE_CONSTRAINTS;

```

CONSTRAINT_CATALOG	CONSTRAINT_SCHEMA	CONSTRAINT_NAME	TABLE_SCHEMA	TABLE_NAME	CONSTRAINT_TYPE
def	sys	PRIMARY	sys	sys_config	PRIMARY KEY
def	Book_Loan_DB	PRIMARY	Book_Loan_DB	Book	PRIMARY KEY
def	Book_Loan_DB	PRIMARY	Book_Loan_DB	Library_Branch	PRIMARY KEY
def	Book_Loan_DB	PRIMARY	Book_Loan_DB	Borrower	PRIMARY KEY
def	Book_Loan_DB	PRIMARY	Book_Loan_DB	Book_Authors	PRIMARY KEY
def	Book_Loan_DB	Book_Authors_ibfk_1	Book_Loan_DB	Book_Authors	FOREIGN KEY
def	Book_Loan_DB	PRIMARY	Book_Loan_DB	Publisher	PRIMARY KEY
def	Book_Loan_DB	PRIMARY	Book_Loan_DB	Book_Loans	PRIMARY KEY
def	Book_Loan_DB	Book_Loans_ibfk_1	Book_Loan_DB	Book_Loans	FOREIGN KEY
def	Book_Loan_DB	Book_Loans_ibfk_2	Book_Loan_DB	Book_Loans	FOREIGN KEY
def	Book_Loan_DB	Book_Loans_ibfk_3	Book_Loan_DB	Book_Loans	FOREIGN KEY
def	Book_Loan_DB	PRIMARY	Book_Loan_DB	Book_Copies	PRIMARY KEY
def	Book_Loan_DB	Book_Copies_ibfk_1	Book_Loan_DB	Book_Copies	FOREIGN KEY
def	mysql	PRIMARY	mysql	time_zone	PRIMARY KEY
def	mysql	PRIMARY	mysql	time_zone_transition	PRIMARY KEY
def	mysql	PRIMARY	mysql	time_zone_name	PRIMARY KEY
def	mysql	PRIMARY	mysql	help_category	PRIMARY KEY
def	mysql	name	mysql	help_category	UNIQUE
def	mysql	PRIMARY	mysql	proc	PRIMARY KEY
def	mysql	PRIMARY	mysql	proxies_priv	PRIMARY KEY
def	mysql	PRIMARY	mysql	func	PRIMARY KEY
def	mysql	PRIMARY	mysql	help_topic	PRIMARY KEY
def	mysql	name	mysql	help_topic	UNIQUE
def	mysql	PRIMARY	mysql	procs_priv	PRIMARY KEY
def	mysql	PRIMARY	mysql	tables_priv	PRIMARY KEY
def	mysql	PRIMARY	mysql	help_relation	PRIMARY KEY
def	mysql	PRIMARY	mysql	plugin	PRIMARY KEY
def	mysql	PRIMARY	mysql	help_keyword	PRIMARY KEY
def	mysql	name	mysql	help_keyword	UNIQUE
def	mysql	PRIMARY	mysql	event	PRIMARY KEY
def	mysql	PRIMARY	mysql	global_priv	PRIMARY KEY
def	mysql	Priv	mysql	global_priv	CHECK
def	mysql	PRIMARY	mysql	innodb_table_stats	PRIMARY KEY
def	mysql	Host	mysql	roles_mapping	UNIQUE
def	mysql	PRIMARY	mysql	transaction_registry	PRIMARY KEY
def	mysql	commit_id	mysql	transaction_registry	UNIQUE
def	mysql	PRIMARY	mysql	innodb_index_stats	PRIMARY KEY
def	mysql	PRIMARY	mysql	time_zone_leap_second	PRIMARY KEY
def	mysql	PRIMARY	mysql	index_stats	PRIMARY KEY
def	mysql	PRIMARY	mysql	gtid_slave_pos	PRIMARY KEY
def	mysql	PRIMARY	mysql	column_stats	PRIMARY KEY
def	mysql	PRIMARY	mysql	table_stats	PRIMARY KEY
def	mysql	PRIMARY	mysql	db	PRIMARY KEY
def	mysql	PRIMARY	mysql	time_zone_transition_type	PRIMARY KEY
def	mysql	PRIMARY	mysql	columns_priv	PRIMARY KEY
def	mysql	PRIMARY	mysql	servers	PRIMARY KEY

```

46 rows in set (0.029 sec)

```

# Verifying Table Schemas

Below, you can see the individual table schemas from the database. In them, you can see which columns are primary keys, which columns are foreign keys, and each column's datatype.

Figure 1: Book Schema

```
| Table | Create Table
-----
| Book | CREATE TABLE `Book` (
  `Book_id` varchar(2) NOT NULL,
  `Title` varchar(255) NOT NULL,
  `Publisher_name` varchar(255) NOT NULL,
  PRIMARY KEY (`Book_id`)
) ENGINE=InnoDB DEFAULT CHARSET=utf8mb4 COLLATE=utf8mb4_general_ci |
-----
1 row in set (0.009 sec)
-----
```

Field	Type	Null	Key	Default	Extra
Book_id	varchar(2)	NO	PRI	NULL	
Title	varchar(255)	NO		NULL	
Publisher_name	varchar(255)	NO		NULL	

```
-----
3 rows in set (0.009 sec)
```

Figure 2: Book\_Authors Schema

Table	Create Table
	Book_Authors   CREATE TABLE `Book_Authors` ( `Book_id` varchar(2) NOT NULL, `Author_name` varchar(255) NOT NULL, PRIMARY KEY (`Book_id`, `Author_name`), CONSTRAINT `Book_Authors_ibfk_1` FOREIGN KEY (`Book_id`) REFERENCES `Book` (`Book_id`) ) ENGINE=InnoDB DEFAULT CHARSET=utf8mb4 COLLATE=utf8mb4_general_ci
1 row in set (0.004 sec)	

Field	Type	Null	Key	Default	Extra
Book_id	varchar(2)	NO	PRI	NULL	
Author_name	varchar(255)	NO	PRI	NULL	

2 rows in set (0.004 sec)
---------------------------

Figure 4: Book.Loans Schema

Figure 3: Book\_Copies Schema

```

+-----+
| Table | Create Table |
+-----+
| Book_Copies | CREATE TABLE `Book_Copies` (
  `Book_id` varchar(2) NOT NULL,
  `Branch_id` varchar(3) NOT NULL,
  `No_of_copies` int(11) NOT NULL,
  PRIMARY KEY (`Book_id`),
  CONSTRAINT `Book_Copies_ibfk_1` FOREIGN KEY (`Book_id`) REFERENCES `Book` (`Book_id`)
) ENGINE=InnoDB DEFAULT CHARSET=utf8mb4 COLLATE=utf8mb4_general_ci |
+-----+
1 row in set (0.001 sec)
+-----+

```

Field	Type	Null	Key	Default	Extra
Book_id	varchar(2)	NO	PRI	NULL	
Branch_id	varchar(3)	NO		NULL	
No_of_copies	int(11)	NO		NULL	

```

+-----+
3 rows in set (0.001 sec)
+-----+

```

Table		Create Table					
<pre>'Book_loans' CREATE TABLE 'Book_loans' (   'Book_id' varchar(2) NOT NULL,   'Branch_id' varchar(3) NOT NULL,   'Card_no' varchar(2) NOT NULL,   'Date_out' date NOT NULL,   'Due_date' date NOT NULL,   PRIMARY KEY ('Book_id', 'Branch_id', 'Card_no'),   KEY 'Branch_id' ('Branch_id'),   KEY 'Card_no' ('Card_no'),   CONSTRAINT 'Book_loans_ibfk_1' FOREIGN KEY ('Book_id') REFERENCES 'Book' ('Book_id'),   CONSTRAINT 'Book_loans_ibfk_2' FOREIGN KEY ('Branch_id') REFERENCES 'Library_Branch' ('Branch_id'),   CONSTRAINT 'Book_loans_ibfk_3' FOREIGN KEY ('Card_no') REFERENCES 'Borrower' ('Card_no') ) ENGINE=InnoDB DEFAULT CHARSET=utf8mb4 COLLATE=utf8mb4_general_ci  </pre>							
1 row in set (0.001 sec)							
Field	Type	Null	Key	Default	Extra		
Book_id	varchar(2)	NO	PRI	NULL			
Branch_id	varchar(3)	NO	PRI	NULL			
Card_no	varchar(2)	NO	PRI	NULL			
Date_out	date	NO		NULL			
Due_date	date	NO		NULL			
5 rows in set (0.002 sec)							

Figure 5: Borrower Schema

Table	Create Table
Borrower	<pre>CREATE TABLE `Borrower` (   `Card_no` varchar(2) NOT NULL,   `Name` varchar(255) NOT NULL,   `Address` varchar(255) NOT NULL,   `Phone` varchar(14) NOT NULL,   PRIMARY KEY (`Card_no`) ) ENGINE=InnoDB DEFAULT CHARSET=utf8mb4 COLLATE=utf8mb4_general_ci  </pre>
1 row in set (0.001 sec)	

Field	Type	Null	Key	Default	Extra
Card_no	varchar(2)	NO	PRI	NULL	
Name	varchar(255)	NO		NULL	
Address	varchar(255)	NO		NULL	
Phone	varchar(14)	NO		NULL	
4 rows in set (0.001 sec)					

Figure 6: Library\_Branch Schema

Table	Create Table				
Library_Branch	<pre>CREATE TABLE `Library_Branch` (   `Branch_id` varchar(3) NOT NULL,   `Branch_name` varchar(255) NOT NULL,   `Address` varchar(255) NOT NULL,   PRIMARY KEY (`Branch_id`) ) ENGINE=InnoDB DEFAULT CHARSET=utf8mb4 COLLATE=utf8mb4_general_ci  </pre>				
1 row in set (0.001 sec)					
Field	Type	Null	Key	Default	Extra
Branch_id	varchar(3)	NO	PRI	NULL	
Branch_name	varchar(255)	NO		NULL	
Address	varchar(255)	NO		NULL	
3 rows in set (0.001 sec)					

Figure 7: Publisher Schema

```

+-----+-----+
| Table | Create Table |
+-----+-----+
| Publisher | CREATE TABLE `Publisher` (  
  `Name` varchar(255) NOT NULL,  
  `Address` varchar(255) NOT NULL,  
  `Phone` varchar(14) NOT NULL,  
  PRIMARY KEY (`Name`,`Address`)  
 ) ENGINE=InnoDB DEFAULT CHARSET=utf8mb4 COLLATE=utf8mb4_general_ci |
+-----+-----+

1 row in set (0.001 sec)

+-----+-----+
| Field | Type | Null | Key | Default | Extra |
+-----+-----+
| Name | varchar(255) | NO | PRI | NULL | |
| Address | varchar(255) | NO | PRI | NULL | |
| Phone | varchar(14) | NO | | NULL | |
+-----+-----+

3 rows in set (0.003 sec)

```

## Verifying Database Contents

```
MariaDB [Book_Loan_DB]> SELECT * FROM Book;
+-----+-----+-----+
| Book_id | Title       | Publisher_name |
+-----+-----+-----+
| B1      | The Lost Tribe | Picador        |
| B2      | It           | Simon & Schuster |
| B3      | Event Horizon | Tom Doherty Assoc Llc |
+-----+-----+-----+
3 rows in set (0.003 sec)
```

Figure 8: Book Values

```
MariaDB [Book_Loan_DB]> SELECT * FROM Book_Authors;
+-----+-----+
| Book_id | Author_name |
+-----+-----+
| B1      | Mark Lee    |
| B2      | Stephen King |
| B3      | Steven McDonald |
+-----+-----+
3 rows in set (0.005 sec)
```

Figure 9: Book\_Authors Values

```
MariaDB [Book_Loan_DB]> SELECT * FROM Book_Copies;
+-----+-----+-----+
| Book_id | Branch_id | No_of_copies |
+-----+-----+-----+
| B1      | BR1       | 15           |
| B2      | BR2       | 10           |
| B3      | BR3       | 20           |
+-----+-----+-----+
3 rows in set (0.003 sec)
```

Figure 10: Book\_Copies Values

```
MariaDB [Book_Loan_DB]> SELECT * FROM Book_Loans;
+-----+-----+-----+-----+-----+
| Book_id | Branch_id | Card_no | Date_out | Due_date |
+-----+-----+-----+-----+-----+
| B1      | BR1       | C1      | 2023-01-05 | 2023-02-05 |
| B2      | BR2       | C2      | 2022-12-06 | 2023-01-06 |
| B3      | BR3       | C2      | 2023-01-29 | 2023-03-01 |
+-----+-----+-----+-----+-----+
3 rows in set (0.008 sec)
```

Figure 11: Book\_Loans Values

```
MariaDB [Book_Loan_DB]> SELECT * FROM Borrower;
+-----+-----+-----+-----+
| Card_no | Name       | Address              | Phone |
+-----+-----+-----+-----+
| C1      | John Smith | 731 Fondren, Houston, TX | (286) 342-8631 |
| C2      | Franklin Wong | 638 Voss, Houston, TX | (717) 550-1675 |
| C3      | Alicia Zelaya | 3321 Castle, Spring, TX | (248) 762-0356 |
+-----+-----+-----+-----+
3 rows in set (0.002 sec)
```

Figure 12: Borrower Values

```
MariaDB [Book_Loan_DB]> SELECT * FROM Library_Branch;
+-----+-----+-----+
| Branch_id | Branch_name | Address |
+-----+-----+-----+
| BR1       | Sharpstown | 9 Bow Ridge Street Sharpstown |
| BR2       | Beloit     | 3 West Rd. Beloit |
| BR3       | Drive Lake Charles | 824 Rock Maple Drive Lake Charles |
+-----+-----+-----+
3 rows in set (0.002 sec)
```

Figure 13: Library\_Branch Values

```
MariaDB [Book_Loan_DB]> SELECT * FROM Publisher;
+-----+-----+-----+
| Name       | Address              | Phone |
+-----+-----+-----+
| Picador    | 4300 Turkey Pen Road | (223) 444-5521 |
| Simon & Schuster | 4096 Emerson Road | (421) 540-1675 |
| Tom Doherty Assoc Llc | 4321 Walnut Hill Drive | (345) 623-0356 |
+-----+-----+-----+
3 rows in set (0.003 sec)
```

Figure 14: Publisher Values