



CSI2132 Tutorial 6

Relational Algebra

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Review #1

OPERATION	PURPOSE	NOTATION
THETA JOIN	Produces all combinations of tuples from R1 and R2 that satisfy a join condition.	$R_1 \bowtie_{\langle \text{join condition} \rangle} R_2$
LEFT OUTER JOIN	Keeps every tuple in the first, or left relation R1. If no matching tuple is found in R2, then the attributes of R2 in the join result are filled or padded with null values.	$R_1 \bowtie_{\langle \text{join condition} \rangle} R_2$
RIGHT OUTER JOIN	Keeps every tuple in the second, or right, relation R2. If no matching tuple is found in R1, then the attributes of R1 in the join result are filled or padded with null values.	$R_1 \bowtie_{\langle \text{join condition} \rangle} R_2$
UNION	Produces a relation that includes all the tuples in R1 or R2 or both R1 and R2; R1 and R2 must be union compatible.	$R_1 \cup R_2$

Exercise #1

Consider the two tables T1 and T2 below. Show the results of the following operations:

- a. $T1 \bowtie_{T1.P = T2.A} T2$
- b. $T1 \bowtie_{T1.Q = T2.B} T2$
- c. $T1 \bowtie_{T1.P = T2.A} T2$
- d. $T1 \bowtie_{T1.Q = T2.B} T2$
- e. $T1 \cup T2$
- f. $T1 \bowtie_{(T1.P = T2.A \textbf{ AND } T1.R = T2.C)} T2$

TABLE T1

P	Q	R
10	a	5
15	b	8
25	a	6

TABLE T2

A	B	C
10	b	6
25	c	3
10	b	5

Exercise #1

Consider the two tables T1 and T2 below. Show the results of the following operations:

a. $T1 \bowtie_{T1.P = T2.A} T2$

TABLE T1

P	Q	R
10	a	5
15	b	8
25	a	6

TABLE T2

A	B	C
10	b	6
25	c	3
10	b	5

Exercise #1

Consider the two tables T1 and T2 below. Show the results of the following operations:

a. $T1 \bowtie_{T1.P = T2.A} T2$

Result:

P	Q	R	A	B	C
10	a	5	10	b	6
10	a	5	10	b	5
25	a	6	25	c	3

TABLE T1

P	Q	R
10	a	5
15	b	8
25	a	6

TABLE T2

A	B	C
10	b	6
25	c	3
10	b	5

Exercise #1

Consider the two tables T1 and T2 below. Show the results of the following operations:

b. $T1 \bowtie_{T1.Q = T2.B} T2$

TABLE T1

P	Q	R
10	a	5
15	b	8
25	a	6

TABLE T2

A	B	C
10	b	6
25	c	3
10	b	5

Exercise #1

Consider the two tables T1 and T2 below. Show the results of the following operations:

b. $T1 \bowtie_{T1.Q = T2.B} T2$

Result:

P	Q	R	A	B	C
15	b	8	10	b	6
15	b	8	10	b	5

TABLE T1

P	Q	R
10	a	5
15	b	8
25	a	6

TABLE T2

A	B	C
10	b	6
25	c	3
10	b	5

Exercise #1

Consider the two tables T1 and T2 below. Show the results of the following operations:

c. $T1 \bowtie_{T1.P = T2.A} T2$

TABLE T1

P	Q	R
10	a	5
15	b	8
25	a	6

TABLE T2

A	B	C
10	b	6
25	c	3
10	b	5

Exercise #1

Consider the two tables T1 and T2 below. Show the results of the following operations:

c. $T1 \bowtie_{T1.P = T2.A} T2$

Result:

P	Q	R	A	B	C
10	a	5	10	b	6
10	a	5	10	b	5
15	b	8	null	null	null
25	a	6	25	c	3

TABLE T1

P	Q	R
10	a	5
15	b	8
25	a	6

TABLE T2

A	B	C
10	b	6
25	c	3
10	b	5

Exercise #1

Consider the two tables T1 and T2 below. Show the results of the following operations:

d. $T1 \bowtie_{T1.Q = T2.B} T2$

TABLE T1

P	Q	R
10	a	5
15	b	8
25	a	6

TABLE T2

A	B	C
10	b	6
25	c	3
10	b	5

Exercise #1

Consider the two tables T1 and T2 below. Show the results of the following operations:

d. $T1 \bowtie_{T1.Q = T2.B} T2$

Result:

P	Q	R	A	B	C
15	b	8	10	b	6
null	null	null	25	c	3
15	b	8	10	b	5

TABLE T1

P	Q	R
10	a	5
15	b	8
25	a	6

TABLE T2

A	B	C
10	b	6
25	c	3
10	b	5

Exercise #1

Consider the two tables T1 and T2 below. Show the results of the following operations:

e. $T1 \cup T2$

TABLE T1

P	Q	R
10	a	5
15	b	8
25	a	6

TABLE T2

A	B	C
10	b	6
25	c	3
10	b	5

Exercise #1

Consider the two tables T1 and T2 below. Show the results of the following operations:

e. $T1 \cup T2$

Result:

P	Q	R
10	a	5
15	b	8
25	a	6
10	b	6
25	c	3
10	b	5

TABLE T1

P	Q	R
10	a	5
15	b	8
25	a	6

TABLE T2

A	B	C
10	b	6
25	c	3
10	b	5

Exercise #1

Consider the two tables T1 and T2 below. Show the results of the following operations:

f. $T1 \bowtie (T1.P = T2.A \text{ AND } T1.R = T2.C) T2$

TABLE T1

P	Q	R
10	a	5
15	b	8
25	a	6

TABLE T2

A	B	C
10	b	6
25	c	3
10	b	5

Exercise #1

Consider the two tables T1 and T2 below. Show the results of the following operations:

f. $T1 \bowtie (T1.P = T2.A \text{ AND } T1.R = T2.C) T2$

Result:

P	Q	R	A	B	C
10	a	5	10	b	5

TABLE T1

P	Q	R
10	a	5
15	b	8
25	a	6

TABLE T2

A	B	C
10	b	6
25	c	3
10	b	5

Review #2

Table 8.1 Operations of Relational Algebra

OPERATION	PURPOSE	NOTATION
<u>SELECT</u>	Selects all tuples that satisfy the selection condition from a relation R .	$\sigma_{\langle \text{selection condition} \rangle}(R)$
<u>PROJECT</u>	Produces a new relation with only some of the attributes of R , and removes duplicate tuples.	$\pi_{\langle \text{attribute list} \rangle}(R)$
THETA JOIN	Produces all combinations of tuples from R_1 and R_2 that satisfy the join condition.	$R_1 \bowtie_{\langle \text{join condition} \rangle} R_2$
EQUIJOIN	Produces all the combinations of tuples from R_1 and R_2 that satisfy a join condition with only equality comparisons.	$R_1 \bowtie_{\langle \text{join condition} \rangle} R_2$, OR $R_1 \bowtie_{(\langle \text{join attributes 1} \rangle, \langle \text{join attributes 2} \rangle)} R_2$
<u>NATURAL JOIN</u>	Same as EQUIJOIN except that the join attributes of R_2 are not included in the resulting relation; if the join attributes have the same names, they do not have to be specified at all.	$R_1 \star_{\langle \text{join condition} \rangle} R_2$, OR $R_1 \star_{(\langle \text{join attributes 1} \rangle, \langle \text{join attributes 2} \rangle)} R_2$ OR $R_1 \star R_2$

Review #2

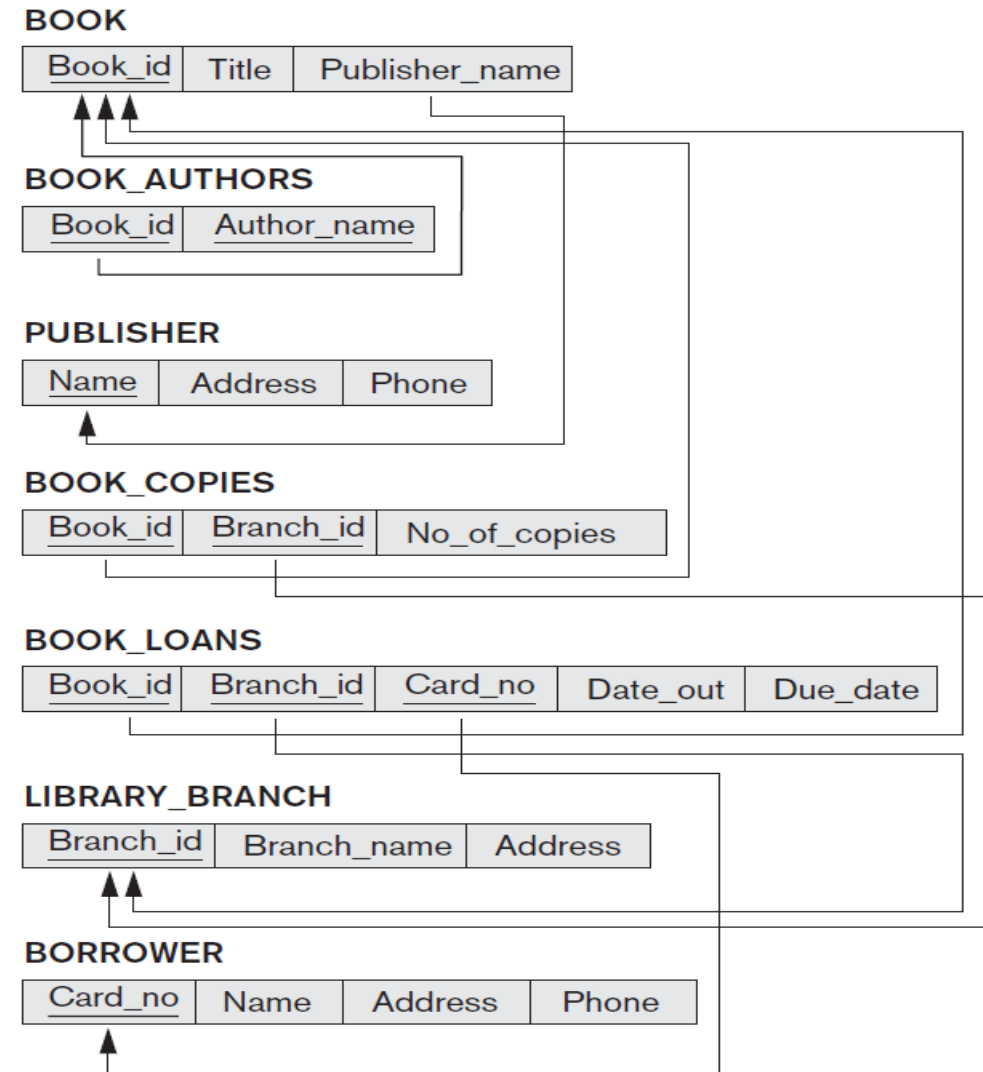
Table 8.1 Operations of Relational Algebra

OPERATION	PURPOSE	NOTATION
UNION	Produces a relation that includes all the tuples in R_1 or R_2 or both R_1 and R_2 ; R_1 and R_2 must be union compatible.	$R_1 \cup R_2$
INTERSECTION	Produces a relation that includes all the tuples in both R_1 and R_2 ; R_1 and R_2 must be union compatible.	$R_1 \cap R_2$
<u>DIFFERENCE</u>	Produces a relation that includes all the tuples in R_1 that are not in R_2 ; R_1 and R_2 must be union compatible.	$R_1 - R_2$
CARTESIAN PRODUCT	Produces a relation that has the attributes of R_1 and R_2 and includes as tuples all possible combinations of tuples from R_1 and R_2 .	$R_1 \times R_2$
DIVISION	Produces a relation $R(X)$ that includes all tuples $t[X]$ in $R_1(Z)$ that appear in R_1 in combination with every tuple from $R_2(Y)$, where $Z = X \cup Y$.	$R_1(Z) \div R_2(Y)$

Exercise #2

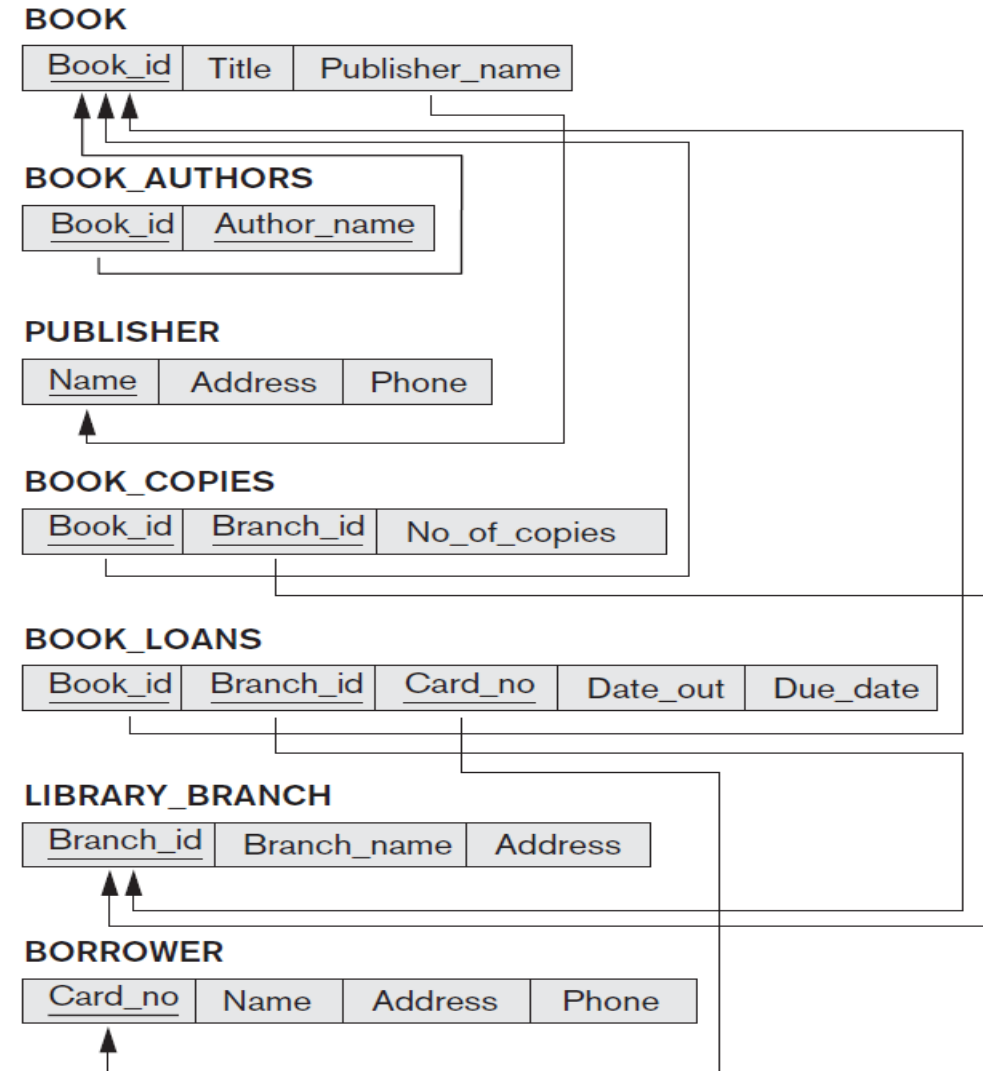
Consider the LIBRARY relational schema shown in the Figure, which is used to keep track of books, borrowers, and book loans. Write down relational expressions for the following queries on the LIBRARY database.

Note: We will use S for SELECT, P for PROJECT, * for NATURAL JOIN, - for SET DIFFERENCE, F for AGGREGATE FUNCTION



Exercise #2

(a) How many copies of the book titled The Lost Tribe are owned by the library branch whose name is "Sharpstown"?



Exercise #2

- (a) How many copies of the book titled The Lost Tribe are owned by the library branch whose name is "Sharpstown"?

```
A <-- BOOKCOPIES * LIBRARY-BRANCH * BOOK  
RESULT <-- P No_Of_Copies ( S BranchName=  
'Sharpstown' and Title='The Lost Tribe'
```

Joins the three tables on their common attributes and saves the output in table A.

BOOK

<u>Book_id</u>	Title	Publisher_name
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BOOK_AUTHORS

<u>Book_id</u>	<u>Author_name</u>
----------------	--------------------

PUBLISHER

<u>Name</u>	Address	Phone
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BOOK_COPIES

<u>Book_id</u>	<u>Branch_id</u>	No_of_copies
----------------	------------------	--------------

BOOK_LOANS

<u>Book_id</u>	<u>Branch_id</u>	<u>Card_no</u>	Date_out	Due_date
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LIBRARY_BRANCH

<u>Branch_id</u>	Branch_name	Address
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BORROWER

<u>Card_no</u>	Name	Address	Phone
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Exercise #2

- (a) How many copies of the book titled The Lost Tribe are owned by the library branch whose name is "Sharpstown"?

```
A <-- BOOKCOPIES * LIBRARY-BRANCH * BOOK
```

```
RESULT <-- P No_Of_Copies ( S Branch_name=  
'Sharpstown' and Title='The Lost Tribe' (A))
```

Joins the three tables on their common attributes and saves the output in table A.

The Select statement filters table A on the rows that have a branch name of Sharpstown and a title of The Lost Tribe. The Project statement produces a new table with only one column of A.

BOOK

<u>Book_id</u>	Title	Publisher_name
----------------	-------	----------------

BOOK_AUTHORS

<u>Book_id</u>	<u>Author_name</u>
----------------	--------------------

PUBLISHER

<u>Name</u>	Address	Phone
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BOOK_COPIES

<u>Book_id</u>	<u>Branch_id</u>	No_of_copies
----------------	------------------	--------------

BOOK_LOANS

<u>Book_id</u>	<u>Branch_id</u>	<u>Card_no</u>	Date_out	Due_date
----------------	------------------	----------------	----------	----------

LIBRARY_BRANCH

<u>Branch_id</u>	Branch_name	Address
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BORROWER

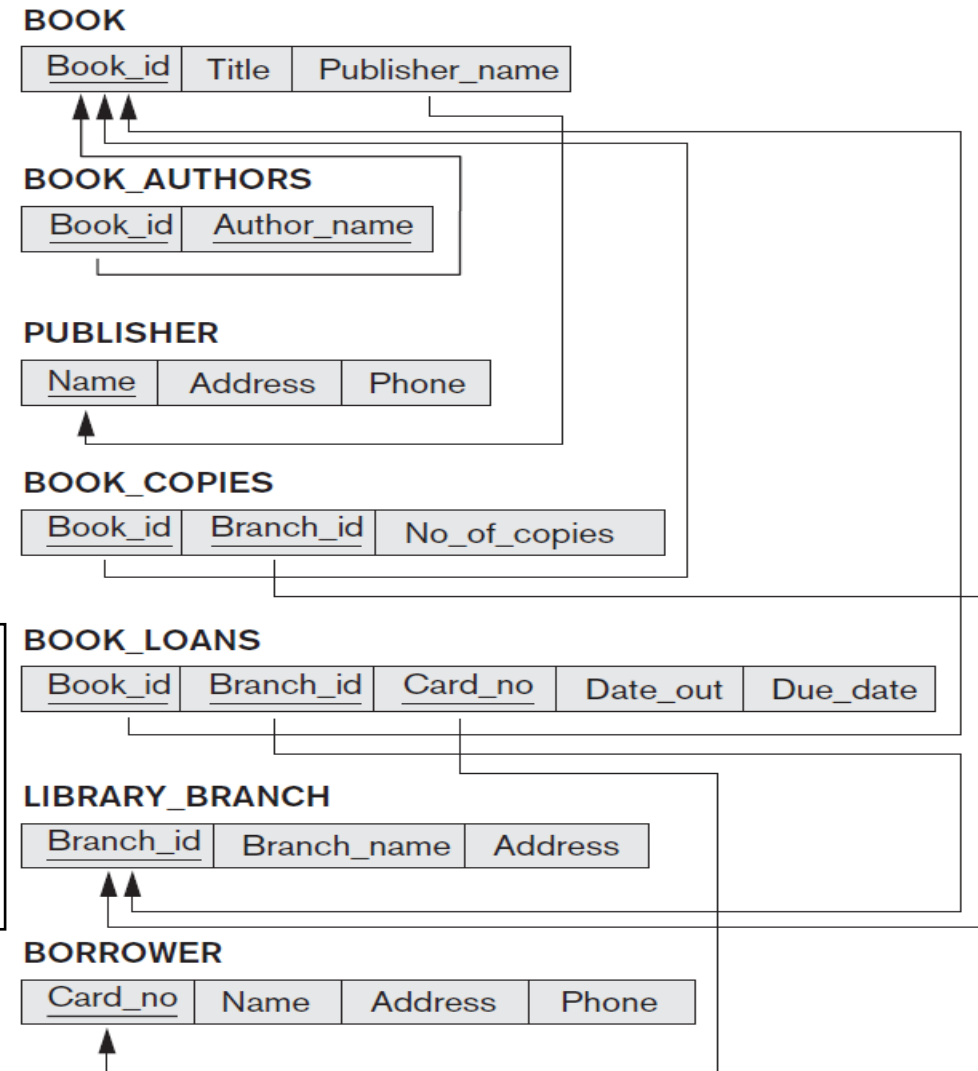
<u>Card_no</u>	Name	Address	Phone
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Exercise #2

- (a) How many copies of the book titled The Lost Tribe are owned by the library branch whose name is "Sharpstown"?

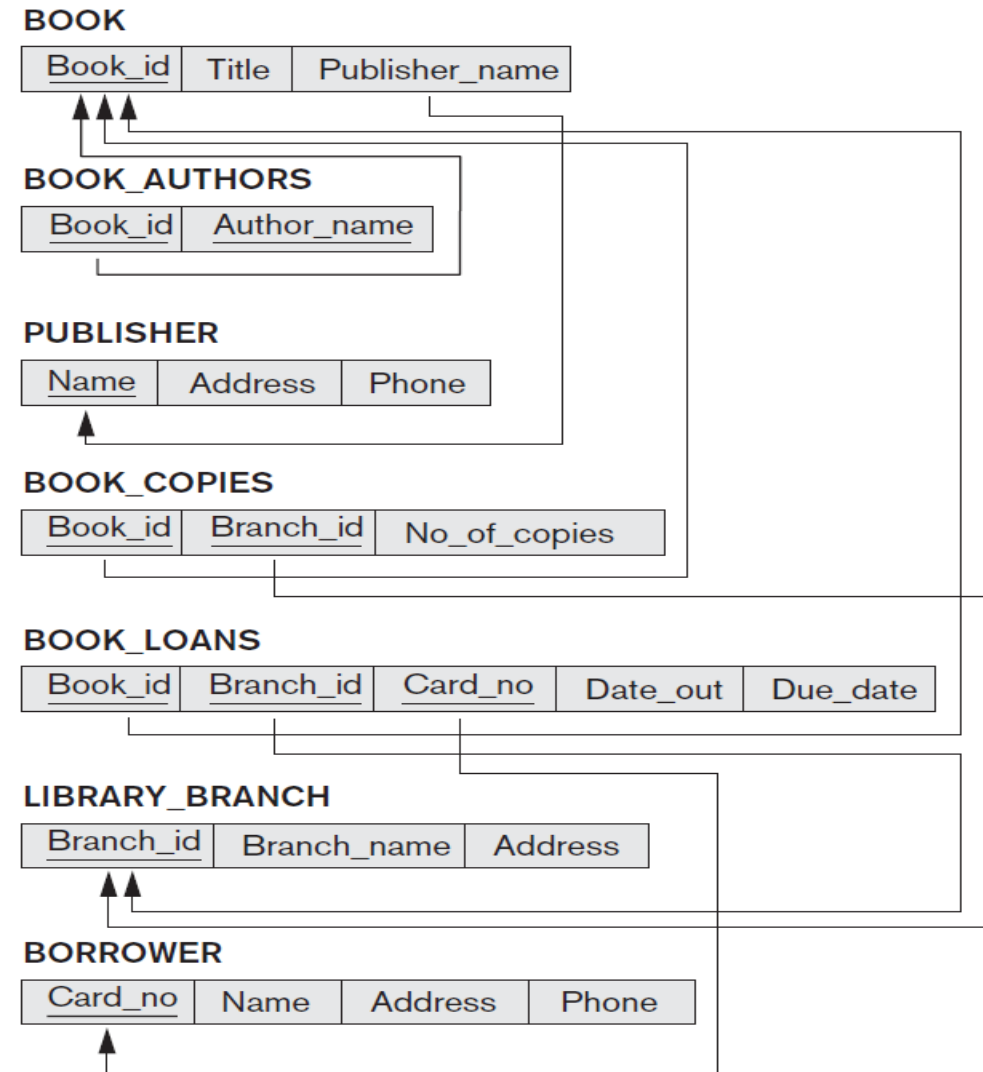
A better query would be to do the SELECTs before the JOIN:

```
A <-- P No_Of_Copies ( ( S
BranchName='Sharpstown' (LIBRARY_BRANCH) ) *
(BOOKCOPIES *
( S Title='The Lost Tribe' (BOOK) ) ) )
```



Exercise #2

(b) How many copies of the book titled The Lost Tribe are owned by each library branch?



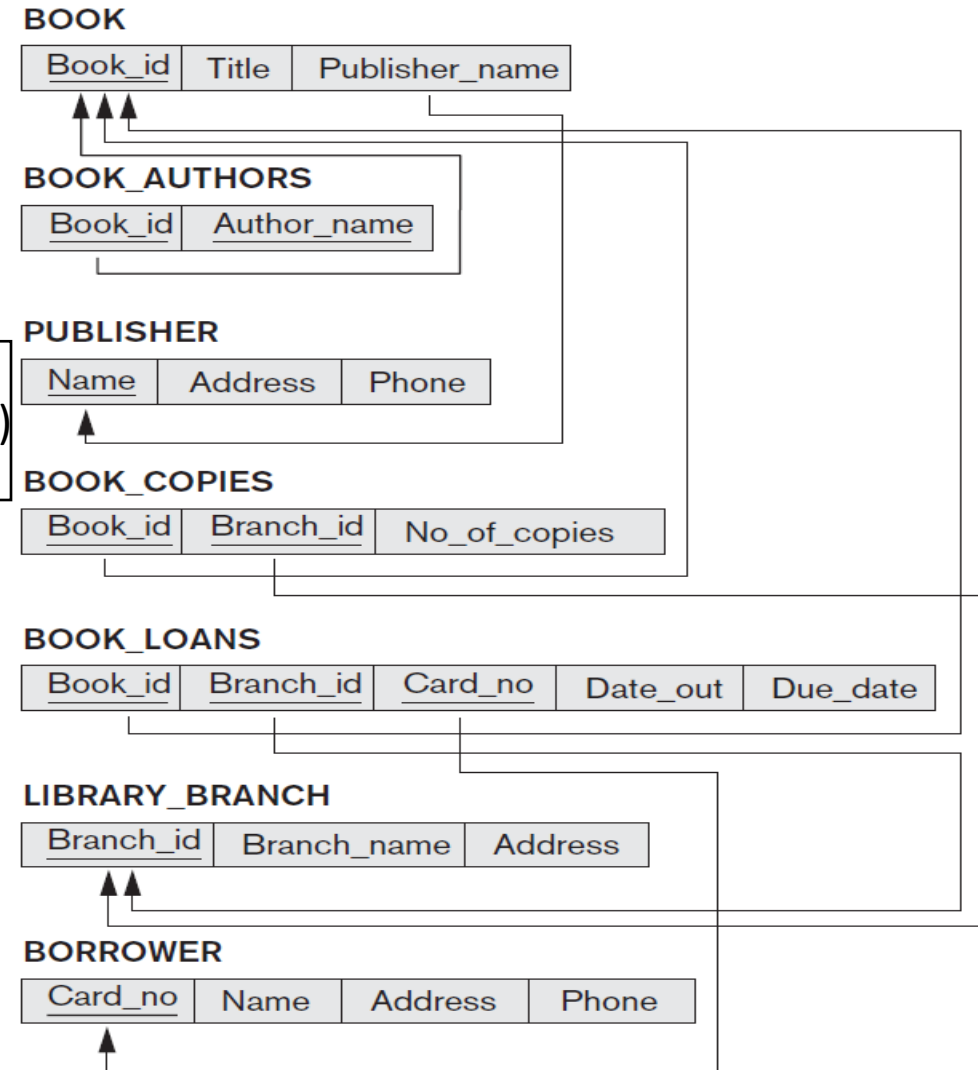
Exercise #2

(b) How many copies of the book titled The Lost Tribe are owned by each library branch?

P BranchID, No_Of_Copies (
(S Title='The Lost Tribe' (BOOK)) *BOOK_COPIES)

First, do a SELECT on the table book where the title of the book is The Lost Tribe.

Then, do a natural join on the result with the table BOOK_COPIES.



Exercise #2

(b) How many copies of the book titled The Lost Tribe are owned by each library branch?

P BranchID, No_Of_Copies (
(S Title='The Lost Tribe' (BOOK)) *BOOK_COPIES)

First, do a SELECT on the table book where the title of the book is The Lost Tribe.

Then, do a natural join on the result with the table BOOK_COPIES.

Last, use PROJECT to only display the columns BranchID and No_Of_Copies

BOOK

<u>Book_id</u>	Title	Publisher_name
----------------	-------	----------------

BOOK_AUTHORS

<u>Book_id</u>	<u>Author_name</u>
----------------	--------------------

PUBLISHER

<u>Name</u>	Address	Phone
-------------	---------	-------

BOOK_COPIES

<u>Book_id</u>	<u>Branch_id</u>	No_of_copies
----------------	------------------	--------------

BOOK_LOANS

<u>Book_id</u>	<u>Branch_id</u>	<u>Card_no</u>	Date_out	Due_date
----------------	------------------	----------------	----------	----------

LIBRARY_BRANCH

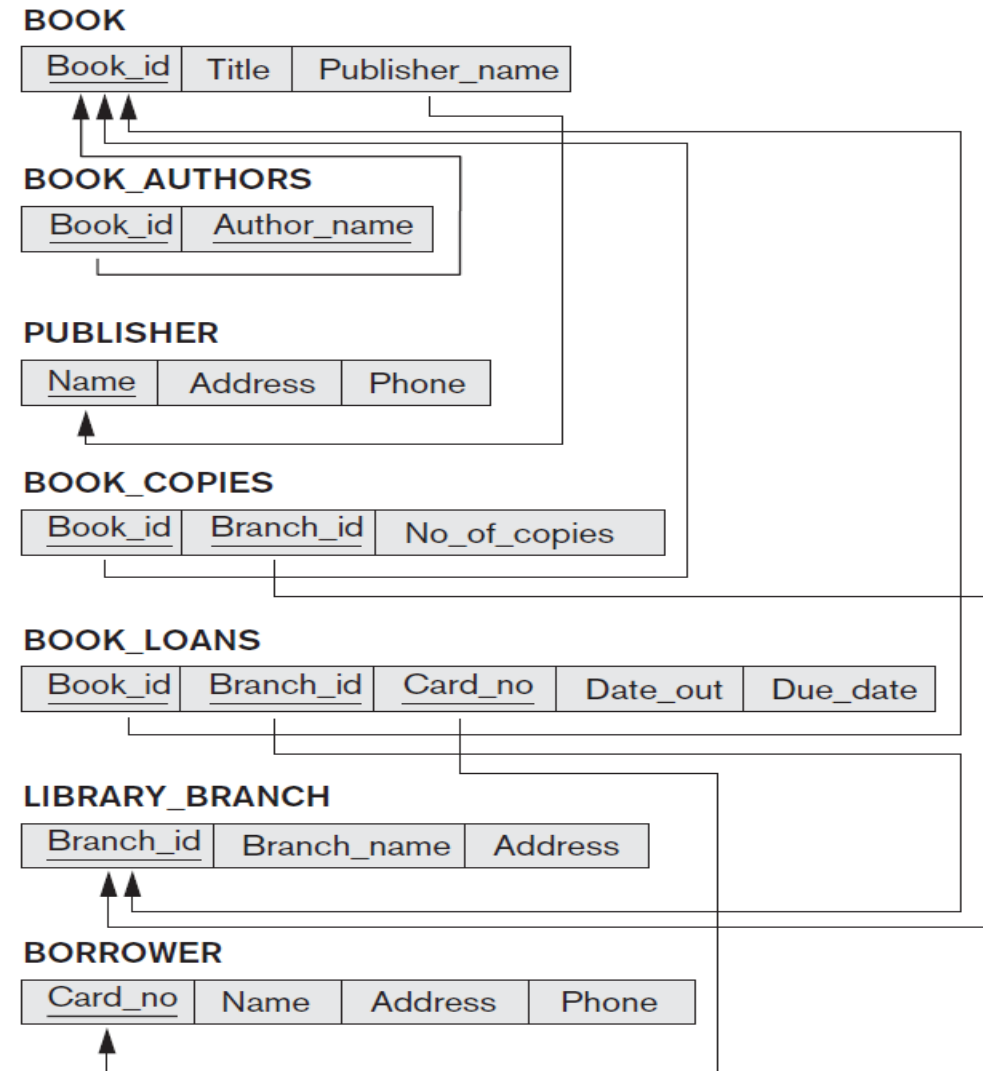
<u>Branch_id</u>	Branch_name	Address
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BORROWER

<u>Card_no</u>	Name	Address	Phone
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Exercise #2

(c) Retrieve the names of all borrowers who do not have any books checked out.



Exercise #2

(c) Retrieve the names of all borrowers who do not have any books checked out.

```
NO_CHECKOUT_B <-- P Card_no (BORROWER) - P  
Card_no (BOOK_LOANS)
```

```
RESULT <-- P Name (BORROWER *NO_CHECKOUT_B)
```

Use Project on tables Borrower and Book_Loans to output the columns that contain the card numbers.

Take the set difference between the CardNo column of table Borrower and the CardNo column of table Book_Loans. This gives you the card numbers of all borrowers who do not have books checked out.

BOOK

<u>Book_id</u>	Title	Publisher_name
----------------	-------	----------------

BOOK_AUTHORS

<u>Book_id</u>	<u>Author_name</u>
----------------	--------------------

PUBLISHER

<u>Name</u>	Address	Phone
-------------	---------	-------

BOOK_COPIES

<u>Book_id</u>	<u>Branch_id</u>	No_of_copies
----------------	------------------	--------------

BOOK_LOANS

<u>Book_id</u>	<u>Branch_id</u>	<u>Card_no</u>	Date_out	Due_date
----------------	------------------	----------------	----------	----------

LIBRARY_BRANCH

<u>Branch_id</u>	Branch_name	Address
------------------	-------------	---------

BORROWER

<u>Card_no</u>	Name	Address	Phone
----------------	------	---------	-------

Exercise #2

(c) Retrieve the names of all borrowers who do not have any books checked out.

```
NO_CHECKOUT_B <-- P Card_no (BORROWER) - P  
Card_no (BOOK_LOANS)
```

```
RESULT <-- P Name (BORROWER *NO_CHECKOUT_B)
```

Use Project on tables Borrower and Book_Loans to output the columns that contain the card numbers.

Take the set difference between the CardNo column of table Borrower and the CardNo column of table Book_Loans. This gives you the card numbers of all borrowers who do not have books checked out.

Join the tables No_Checkout_B and Borrower and output the Name column.

BOOK

<u>Book_id</u>	Title	Publisher_name
----------------	-------	----------------

BOOK_AUTHORS

<u>Book_id</u>	<u>Author_name</u>
----------------	--------------------

PUBLISHER

<u>Name</u>	Address	Phone
-------------	---------	-------

BOOK_COPIES

<u>Book_id</u>	<u>Branch_id</u>	No_of_copies
----------------	------------------	--------------

BOOK_LOANS

<u>Book_id</u>	<u>Branch_id</u>	<u>Card_no</u>	Date_out	Due_date
----------------	------------------	----------------	----------	----------

LIBRARY_BRANCH

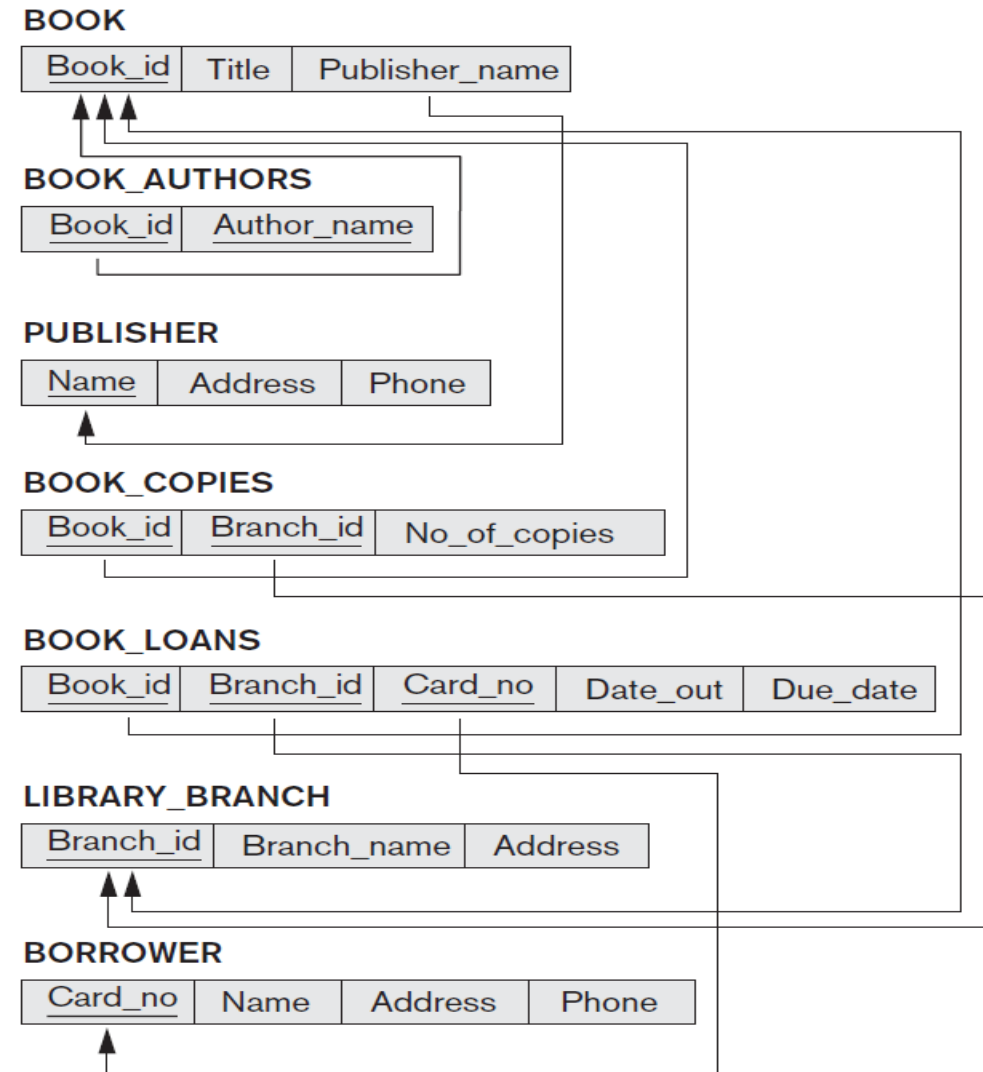
<u>Branch_id</u>	Branch_name	Address
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BORROWER

<u>Card_no</u>	Name	Address	Phone
----------------	------	---------	-------

Exercise #2

(d) For each book that is loaned out from the "Sharpstown" branch and whose due date is today, retrieve the book title, the borrower's name, and the borrower's address.



Exercise #2

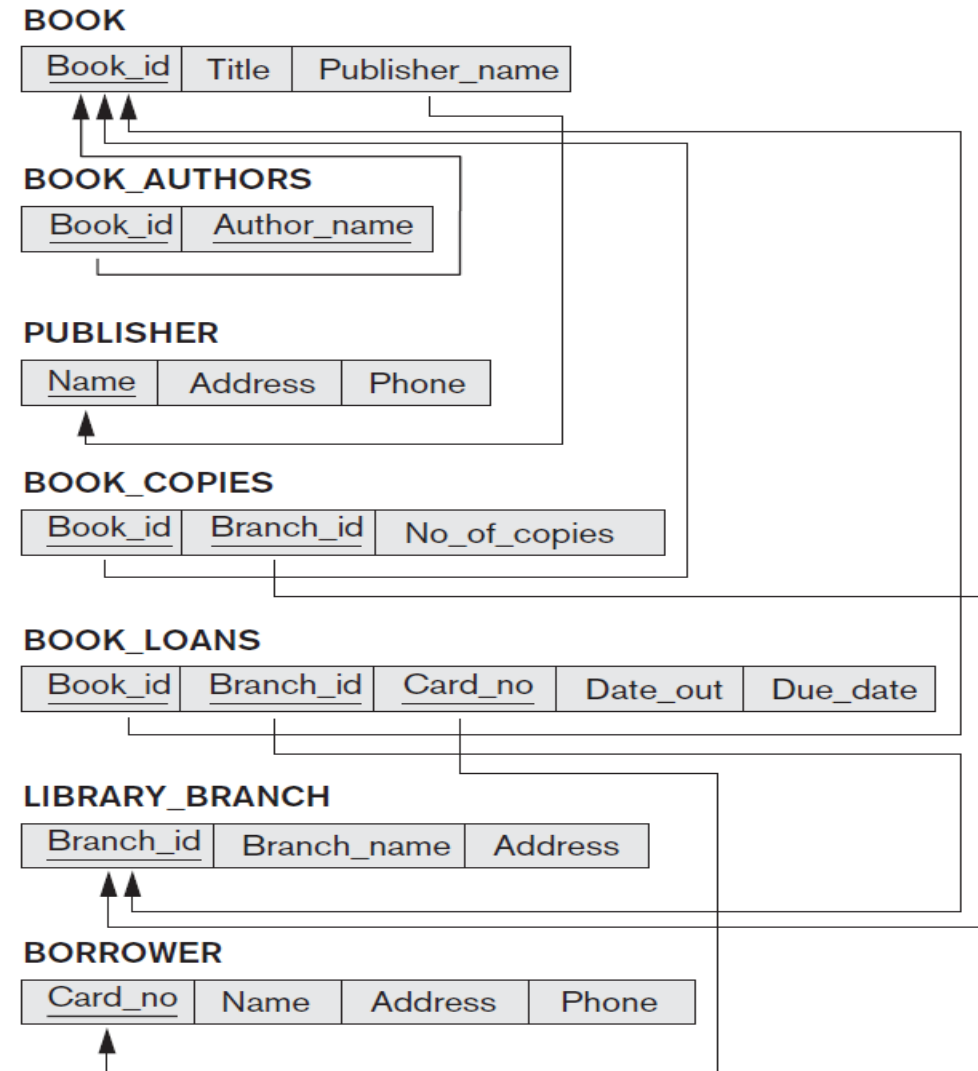
(d) For each book that is loaned out from the "Sharpstown" branch and whose due date is today, retrieve the book title, the borrower's name, and the borrower's address.

```
S <-- P BranchId ( S BranchName='Sharpstown'
(LIBRARY_BRANCH) )
```

```
B_FROM_S <-- P BookId,CardNo ( ( S
DueDate='today' (BOOK_LOANS) ) * S )
```

```
RESULT <-- P Title,Name,Address ( BOOK *
BORROWER * B_FROM_S )
```

Save the branch ids that have a library branch name Sharpstown in table S.



Exercise #2

(d) For each book that is loaned out from the "Sharpstown" branch and whose due date is today, retrieve the book title, the borrower's name, and the borrower's address.

```
S <-- P BranchId ( S BranchName='Sharpstown'
(LIBRARY_BRANCH) )
```

```
B_FROM_S <-- P BookId,CardNo ( ( S
DueDate='today' (BOOK_LOANS) ) * S )
```

```
RESULT <-- P Title,Name,Address ( BOOK *
BORROWER * B_FROM_S )
```

Save the branch ids that have a library branch name Sharpstown in table S.

Save the book ids and card #s of books that have a due date of today in table B_FROM_S

BOOK

<u>Book_id</u>	Title	Publisher_name
----------------	-------	----------------

BOOK_AUTHORS

<u>Book_id</u>	<u>Author_name</u>
----------------	--------------------

PUBLISHER

<u>Name</u>	Address	Phone
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BOOK_COPIES

<u>Book_id</u>	<u>Branch_id</u>	No_of_copies
----------------	------------------	--------------

BOOK_LOANS

<u>Book_id</u>	<u>Branch_id</u>	<u>Card_no</u>	Date_out	Due_date
----------------	------------------	----------------	----------	----------

LIBRARY_BRANCH

<u>Branch_id</u>	Branch_name	Address
------------------	-------------	---------

BORROWER

<u>Card_no</u>	Name	Address	Phone
----------------	------	---------	-------

Exercise #2

(d) For each book that is loaned out from the "Sharpstown" branch and whose due date is today, retrieve the book title, the borrower's name, and the borrower's address.

```
S <-- P BranchId ( S BranchName='Sharpstown'
(LIBRARY_BRANCH) )
```

```
B_FROM_S <-- P BookId,CardNo ( ( S
DueDate='today' (BOOK_LOANS) ) * S )
```

```
RESULT <-- P Title,Name,Address ( BOOK *
BORROWER * B_FROM_S )
```

Save the branch ids that have a library branch name Sharpstown in table S.

Save the book ids and card #s of books that have a due date of today in table B_FROM_S

Save the book titles, names and addresses of books that are in branch Sharpstown and are due today in table RESULT

BOOK

<u>Book_id</u>	Title	Publisher_name
----------------	-------	----------------

BOOK_AUTHORS

<u>Book_id</u>	<u>Author_name</u>
----------------	--------------------

PUBLISHER

<u>Name</u>	Address	Phone
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BOOK_COPIES

<u>Book_id</u>	<u>Branch_id</u>	No_of_copies
----------------	------------------	--------------

BOOK_LOANS

<u>Book_id</u>	<u>Branch_id</u>	<u>Card_no</u>	Date_out	Due_date
----------------	------------------	----------------	----------	----------

LIBRARY_BRANCH

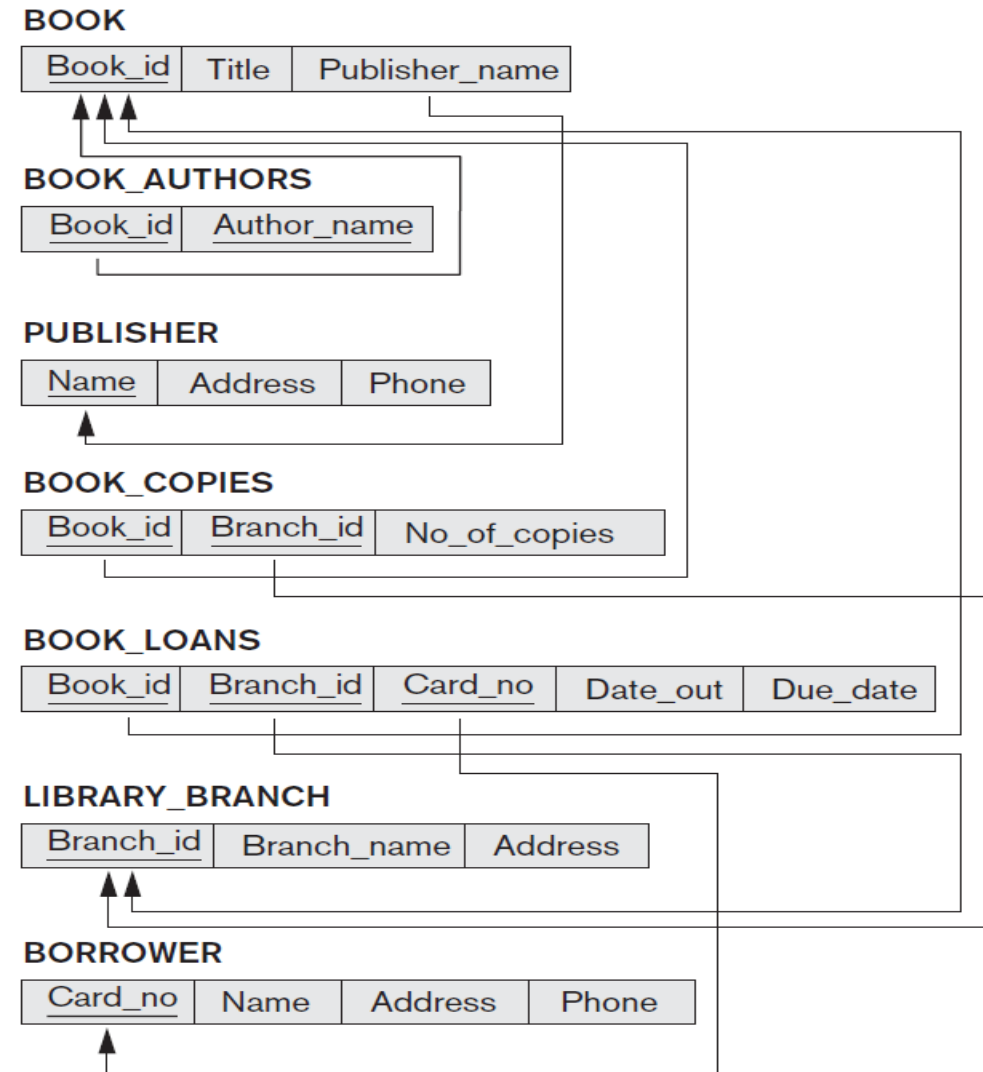
<u>Branch_id</u>	Branch_name	Address
------------------	-------------	---------

BORROWER

<u>Card_no</u>	Name	Address	Phone
----------------	------	---------	-------

Exercise #2

(e) For each library branch, retrieve the branch name and the total number of books loaned out from that branch.



Exercise #2

(e) For each library branch, retrieve the branch name and the total number of book loans that have been made from that branch.

```
R(BranchId,Total) <-- BranchId F COUNT(BookId)
(BOOK_LOANS)
```

```
RESULT <-- P BranchName,Total (R *
LIBRARY_BRANCH)
```

Retrieve the branch_id and total number of books for each branch id in the Book_Loans table.

BOOK

<u>Book_id</u>	Title	Publisher_name
----------------	-------	----------------

BOOK_AUTHORS

<u>Book_id</u>	<u>Author_name</u>
----------------	--------------------

PUBLISHER

<u>Name</u>	Address	Phone
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BOOK_COPIES

<u>Book_id</u>	<u>Branch_id</u>	No_of_copies
----------------	------------------	--------------

BOOK_LOANS

<u>Book_id</u>	<u>Branch_id</u>	<u>Card_no</u>	Date_out	Due_date
----------------	------------------	----------------	----------	----------

LIBRARY_BRANCH

<u>Branch_id</u>	Branch_name	Address
------------------	-------------	---------

BORROWER

<u>Card_no</u>	Name	Address	Phone
----------------	------	---------	-------

Exercise #2

(e) For each library branch, retrieve the branch name and the total number of books loaned out from that branch.

```
R(BranchId,Total) <-- BranchId F COUNT(BookId)
(BOOK_LOANS)
```

```
RESULT <-- P BranchName,Total (R *
LIBRARY_BRANCH)
```

Retrieve the branch_id and total number of books for each branch id in the Book_Loans table.

Retrieve the branch name and total number of books for each library branch id

BOOK

<u>Book_id</u>	Title	Publisher_name
----------------	-------	----------------

BOOK_AUTHORS

<u>Book_id</u>	<u>Author_name</u>
----------------	--------------------

PUBLISHER

<u>Name</u>	Address	Phone
-------------	---------	-------

BOOK_COPIES

<u>Book_id</u>	<u>Branch_id</u>	No_of_copies
----------------	------------------	--------------

BOOK_LOANS

<u>Book_id</u>	<u>Branch_id</u>	<u>Card_no</u>	Date_out	Due_date
----------------	------------------	----------------	----------	----------

LIBRARY_BRANCH

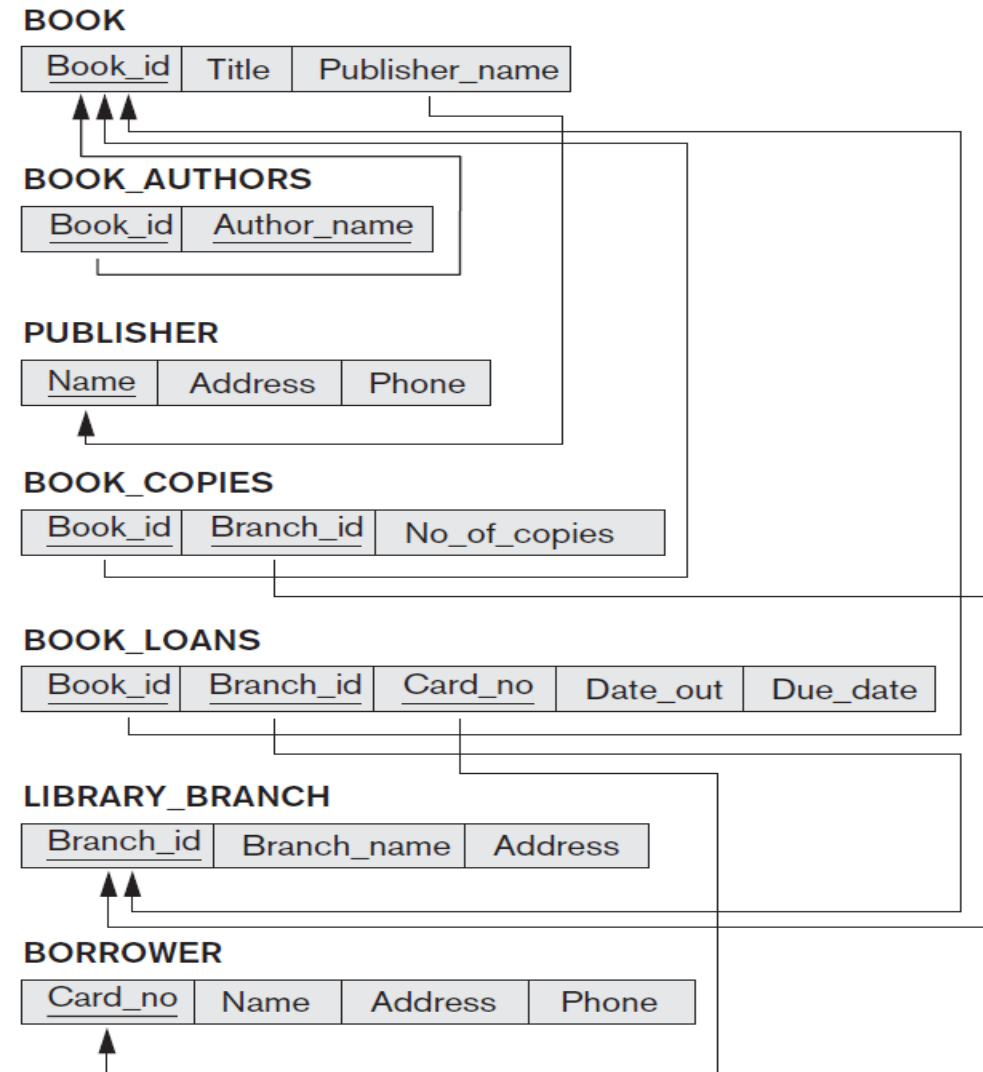
<u>Branch_id</u>	Branch_name	Address
------------------	-------------	---------

BORROWER

<u>Card_no</u>	Name	Address	Phone
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Exercise #2

(f) Retrieve the names, addresses, and number of books checked out for all borrowers who have more than five books checked out.



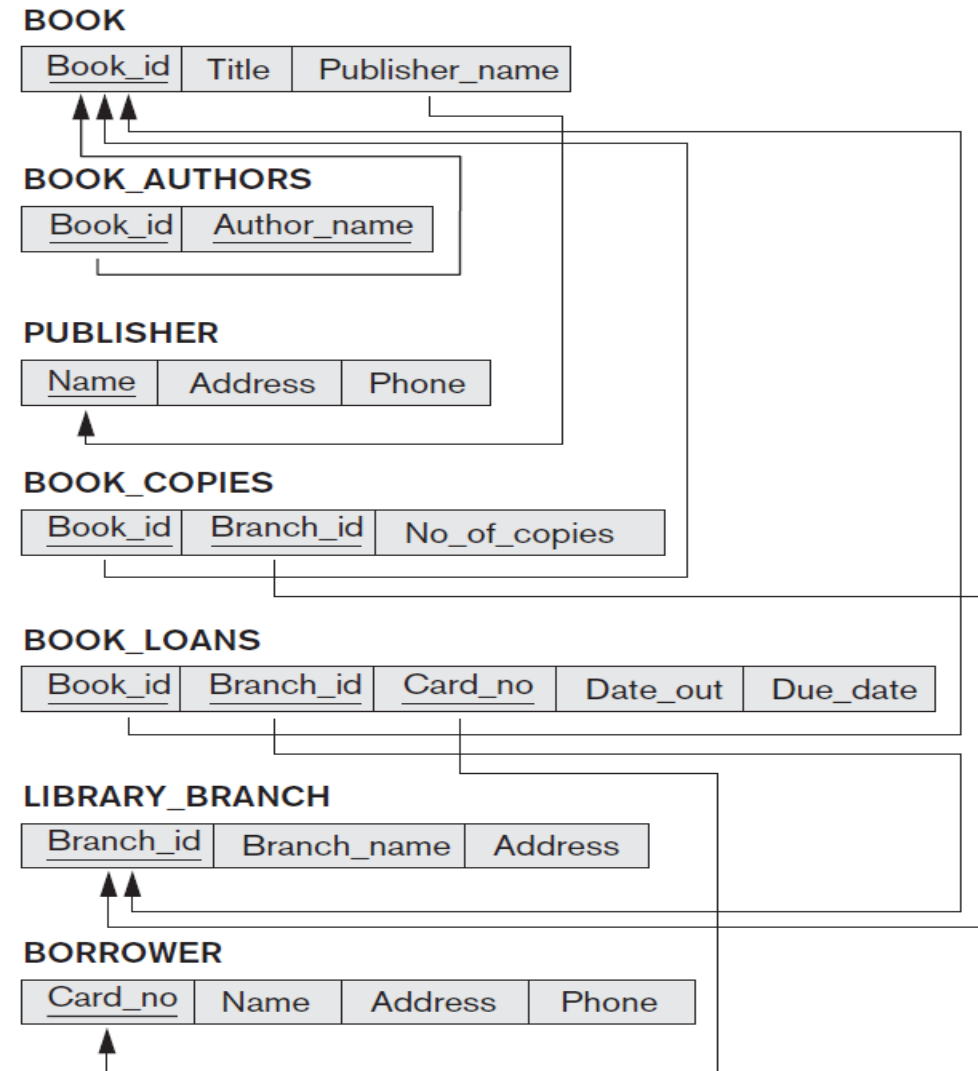
Exercise #2

(f) Retrieve the names, addresses, and number of books checked out for all borrowers who have more than five books checked out.

```
B(CardNo,TotalCheckout) <-- CardNo F  
COUNT(BookId) (BOOK_LOANS)
```

```
B5 <-- S TotalCheckout > 5 (B)
```

```
RESULT <-- P Name,Address,TotalCheckout ( B5 *  
BORROWER)
```



Exercise #2

(f) Retrieve the names, addresses, and number of books checked out for all borrowers who have more than five books checked out.

```
B(CardNo,TotalCheckout) <-- CardNo F  
COUNT(BookId) (BOOK_LOANS)
```

```
B5 <-- S TotalCheckout > 5 (B)
```

```
RESULT <-- P Name,Address,TotalCheckout ( B5 *  
BORROWER)
```

Retrieve the number of books checked out for each card number and save it in B

BOOK

<u>Book_id</u>	Title	Publisher_name
----------------	-------	----------------

BOOK_AUTHORS

<u>Book_id</u>	<u>Author_name</u>
----------------	--------------------

PUBLISHER

<u>Name</u>	Address	Phone
-------------	---------	-------

BOOK_COPIES

<u>Book_id</u>	<u>Branch_id</u>	No_of_copies
----------------	------------------	--------------

BOOK_LOANS

<u>Book_id</u>	<u>Branch_id</u>	<u>Card_no</u>	Date_out	Due_date
----------------	------------------	----------------	----------	----------

LIBRARY_BRANCH

<u>Branch_id</u>	Branch_name	Address
------------------	-------------	---------

BORROWER

<u>Card_no</u>	Name	Address	Phone
----------------	------	---------	-------

Exercise #2

(f) Retrieve the names, addresses, and number of books checked out for all borrowers who have more than five books checked out.

```
B(CardNo,TotalCheckout) <-- CardNo F  
COUNT(BookId) (BOOK_LOANS)
```

```
B5 <-- S TotalCheckout > 5 (B)
```

```
RESULT <-- P Name,Address,TotalCheckout ( B5 *  
BORROWER)
```

Retrieve the number of books checked out for each card number and save it in B

Save the rows in table B that have ore than 5 books checked out in table B5.

BOOK

<u>Book_id</u>	Title	Publisher_name
----------------	-------	----------------

BOOK_AUTHORS

<u>Book_id</u>	<u>Author_name</u>
----------------	--------------------

PUBLISHER

<u>Name</u>	Address	Phone
-------------	---------	-------

BOOK_COPIES

<u>Book_id</u>	<u>Branch_id</u>	No_of_copies
----------------	------------------	--------------

BOOK_LOANS

<u>Book_id</u>	<u>Branch_id</u>	<u>Card_no</u>	Date_out	Due_date
----------------	------------------	----------------	----------	----------

LIBRARY_BRANCH

<u>Branch_id</u>	Branch_name	Address
------------------	-------------	---------

BORROWER

<u>Card_no</u>	Name	Address	Phone
----------------	------	---------	-------

Exercise #2

(f) Retrieve the names, addresses, and number of books checked out for all borrowers who have more than five books checked out.

```
B(CardNo,TotalCheckout) <-- CardNo F  
COUNT(BookId) (BOOK_LOANS)
```

```
B5 <-- S TotalCheckout > 5 (B)
```

```
RESULT <-- P Name,Address,TotalCheckout ( B5 *  
BORROWER)
```

Retrieve the number of books checked out for each card number and save it in B

Save the rows in table B that have more than 5 books checked out in table B5.

Join tables B5 and Borrower and retrieve the name address and number of books checked out for each borrower.

BOOK

<u>Book_id</u>	Title	Publisher_name
----------------	-------	----------------

BOOK_AUTHORS

<u>Book_id</u>	<u>Author_name</u>
----------------	--------------------

PUBLISHER

<u>Name</u>	Address	Phone
-------------	---------	-------

BOOK_COPIES

<u>Book_id</u>	<u>Branch_id</u>	No_of_copies
----------------	------------------	--------------

BOOK_LOANS

<u>Book_id</u>	<u>Branch_id</u>	<u>Card_no</u>	Date_out	Due_date
----------------	------------------	----------------	----------	----------

LIBRARY_BRANCH

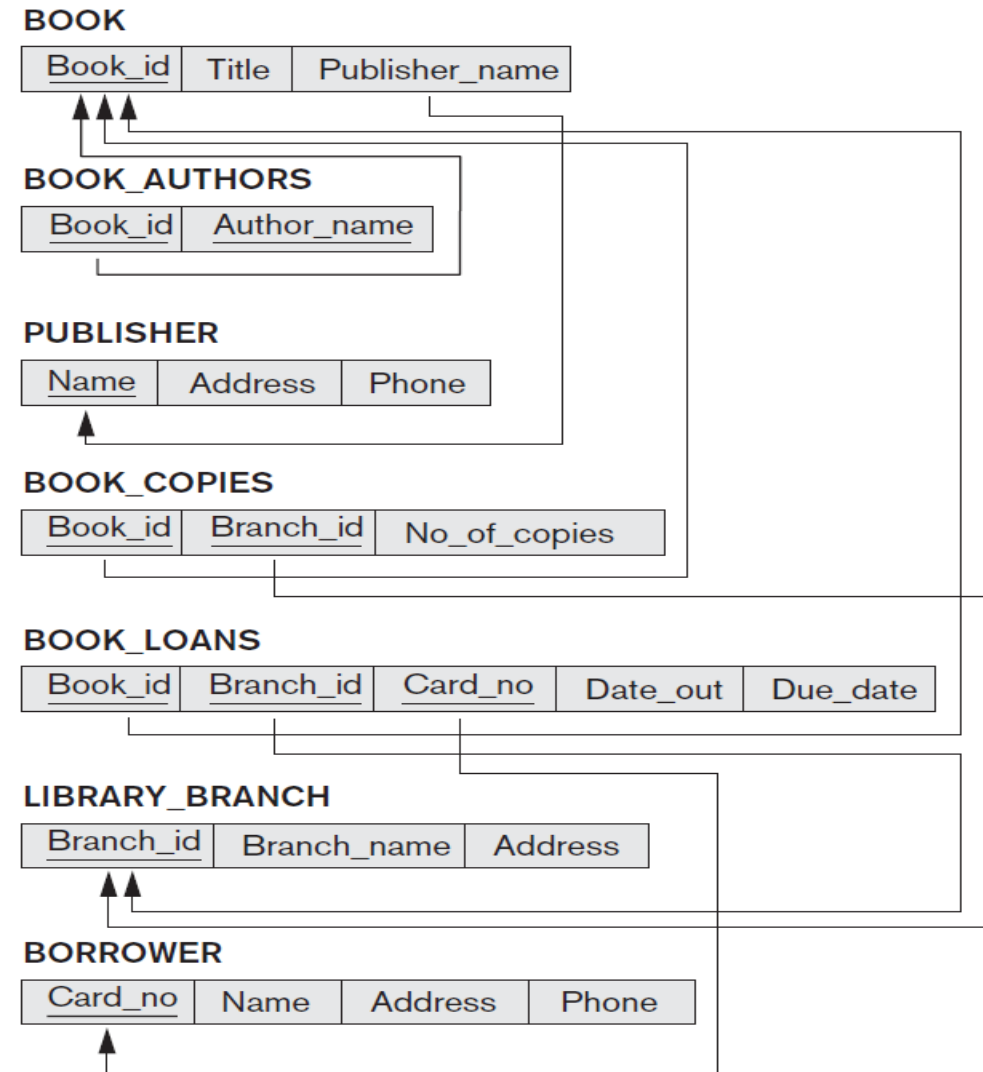
<u>Branch_id</u>	Branch_name	Address
------------------	-------------	---------

BORROWER

<u>Card_no</u>	Name	Address	Phone
----------------	------	---------	-------

Exercise #2

(g) For each book authored (or co-authored) by "Stephen King", retrieve the title and the number of copies owned by the library branch whose name is "Central".



Exercise #2

(g) For each book authored (or co-authored) by "Stephen King", retrieve the title and the number of copies owned by the library branch whose name is "Central".

```
SK <-- P Book_id, Title ( S AuthorName='Stephen King' ( BOOK_AUTHORS)) * BOOK
```

```
CENTRAL(BranchId) <-- S BranchName='Central' ( LIBRARY_BRANCH )
```

```
RESULT <-- P Title,NoOfCopies ( SK * BOOKCOPIES * CENTRAL )
```

BOOK

<u>Book_id</u>	Title	Publisher_name
----------------	-------	----------------

BOOK_AUTHORS

<u>Book_id</u>	<u>Author_name</u>
----------------	--------------------

PUBLISHER

<u>Name</u>	Address	Phone
-------------	---------	-------

BOOK_COPIES

<u>Book_id</u>	<u>Branch_id</u>	No_of_copies
----------------	------------------	--------------

BOOK_LOANS

<u>Book_id</u>	<u>Branch_id</u>	<u>Card_no</u>	Date_out	Due_date
----------------	------------------	----------------	----------	----------

LIBRARY_BRANCH

<u>Branch_id</u>	Branch_name	Address
------------------	-------------	---------

BORROWER

<u>Card_no</u>	Name	Address	Phone
----------------	------	---------	-------

Exercise #2

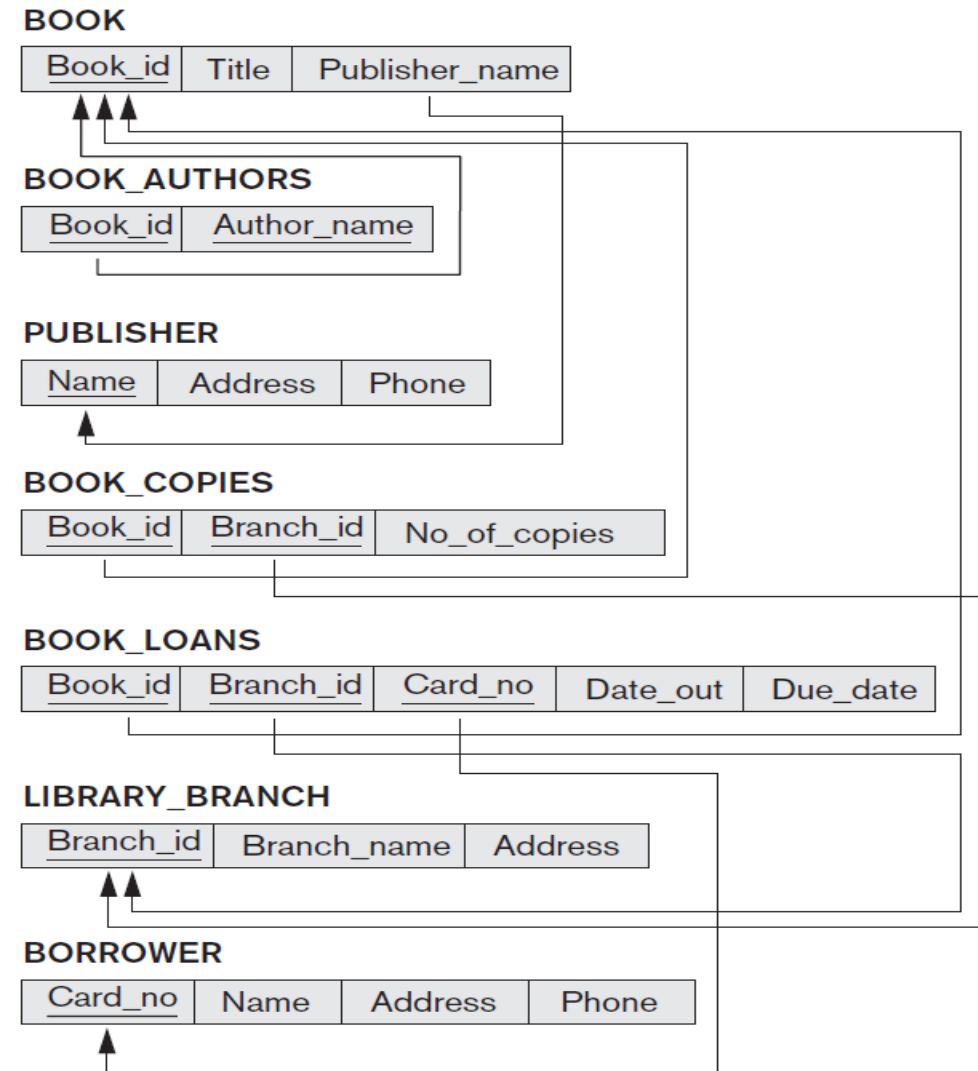
(g) For each book authored (or co-authored) by "Stephen King", retrieve the title and the number of copies owned by the library branch whose name is "Central".

```
SK <-- P Book_id, Title ( S AuthorName='Stephen King' ( BOOK_AUTHORS)) * BOOK
```

```
CENTRAL(BranchId) <-- S BranchName='Central' ( LIBRARY_BRANCH )
```

```
RESULT <-- P Title,NoOfCopies ( SK * BOOKCOPIES * CENTRAL )
```

Retrieve the book id and title of the book that was authored by Sephan King



Exercise #2

(g) For each book authored (or co-authored) by "Stephen King", retrieve the title and the number of copies owned by the library branch whose name is "Central".

```
SK <-- P Book_id, Title ( S AuthorName='Stephen King' ( BOOK_AUTHORS)) * BOOK
```

```
CENTRAL(BranchId) <-- S BranchName='Central' ( LIBRARY_BRANCH )
```

```
RESULT <-- P Title,NoOfCopies ( SK * BOOKCOPIES * CENTRAL )
```

Retrieve the book id and title of the book that was authored by Sephan King

Retrieve the branch ids of the library branches whose name is Central

BOOK

<u>Book_id</u>	Title	Publisher_name
----------------	-------	----------------

BOOK_AUTHORS

<u>Book_id</u>	<u>Author_name</u>
----------------	--------------------

PUBLISHER

<u>Name</u>	Address	Phone
-------------	---------	-------

BOOK_COPIES

<u>Book_id</u>	<u>Branch_id</u>	No_of_copies
----------------	------------------	--------------

BOOK_LOANS

<u>Book_id</u>	<u>Branch_id</u>	<u>Card_no</u>	Date_out	Due_date
----------------	------------------	----------------	----------	----------

LIBRARY_BRANCH

<u>Branch_id</u>	Branch_name	Address
------------------	-------------	---------

BORROWER

<u>Card_no</u>	Name	Address	Phone
----------------	------	---------	-------

Exercise #2

(g) For each book authored (or co-authored) by "Stephen King", retrieve the title and the number of copies owned by the library branch whose name is "Central".

```
SK <-- P Book_id, Title ( S AuthorName='Stephen King' ( BOOK_AUTHORS)) * BOOK
```

```
CENTRAL(BranchId) <-- S BranchName='Central' ( LIBRARY_BRANCH )
```

```
RESULT <-- P Title,NoOfCopies ( SK * BOOKCOPIES * CENTRAL )
```

Retrieve the book id and title of the book that was authored by Sephan King

Retrieve the branch ids of the library branches whose name is Central

Retrieve the Titles and # of copies of books that have been authored by Stephan king and owned by Central library branch.

BOOK

<u>Book_id</u>	Title	Publisher_name
----------------	-------	----------------

BOOK_AUTHORS

<u>Book_id</u>	<u>Author_name</u>
----------------	--------------------

PUBLISHER

<u>Name</u>	Address	Phone
-------------	---------	-------

BOOK_COPIES

<u>Book_id</u>	<u>Branch_id</u>	No_of_copies
----------------	------------------	--------------

BOOK_LOANS

<u>Book_id</u>	<u>Branch_id</u>	<u>Card_no</u>	Date_out	Due_date
----------------	------------------	----------------	----------	----------

LIBRARY_BRANCH

<u>Branch_id</u>	Branch_name	Address
------------------	-------------	---------

BORROWER

<u>Card_no</u>	Name	Address	Phone
----------------	------	---------	-------