

KEYS:      $\sigma = \sigma$       $\text{aggregate} = \Sigma$       $\text{join} = \bowtie$       $\text{project} = \pi$

6.18

a.

SHARP  $\leftarrow \sigma_{\text{Branch\_Name}='Sharpstown'}(\text{LIBRARY\_BRANCH})$   
TRIBE  $\leftarrow \sigma_{\text{Title}='The Lost Tribe'}(\text{BOOK})$   
RESULT  $\leftarrow \sigma_{\text{Branch\_id}=\text{SHARP.Branch\_id} \text{ AND } \text{Book\_id} = \text{TRIBE.Book\_id}}(\text{BOOK\_COPY})$

Book_id	Branch_id	No_of_copies
45362	062	21

```
SELECT * AS SHARP
FROM LIBRARY_BRANCH
WHERE Branch_Name = 'Sharpstown';
```

```
SELECT * AS TRIBE
FROM BOOK
WHERE Title = 'The Lost Tribe';
```

```
SELECT * AS RESULT
FROM BOOK_COPY
WHERE Branch_id = SHARP.Branch_id
      AND
      Book_id = TRIBE.Book_id;
```

b.

TRIBE  $\leftarrow \sigma_{\text{Title}='The Lost Tribe'}(\text{BOOK})$   
RESULT  $\leftarrow \text{TRIBE} \bowtie_{\text{TRIBE.Book\_id} = \text{BOOK\_COPY.Book\_id}} \text{BOOK\_COPY}$

Book_id	Title	Publisher_name	Branch_id	No_of_copies
45362	The Lost Tribe	Roy Henz	062	21
45362	The Lost Tribe	Roy Henz	071	10

```
SELECT * AS TRIBE
FROM BOOK
WHERE Title = 'The Lost Tribe';
```

```
SELECT * AS RESULT
FROM TRIBE
INNER JOIN BOOK_COPY
ON TRIBE.Book_id = BOOK_COPY.Book_id;
```

c.

RESULT  $\leftarrow$  BARROWER  $\mid><\mid$  BARROWER.Card\_no  $\neq$  BOOK\_LOANS.Card\_no BOOK\_LOANS  
 $\pi_{\text{Card\_no, Name}}$ (RESULT)

or you could use:

RESULT  $\leftarrow$  BARROWER  $-$  BOOK\_LOANS

Card_no	Name
212	Bob Myer
161	Ryan Lockman

```
SELECT * AS RESULT
FROM BARROWERS
INNER JOIN BOOK_LOANS
ON BARROWER.Card_no  $\neq$  BOOK_LOANS.Card_no;
```

```
SELECT DISTINCT RESULT.Card_no, RESULT.Name
FROM RESULT;
```

d.

SHARP  $\leftarrow$   $O \sim_{\text{Branch\_Name='Sharpstown'}}$  (LIBRARY\_BRANCH)  
S\_BOOKS\_OUT  $\leftarrow$   $O \sim_{\text{Branch\_id= SHARP.Branch\_id AND Due\_date='2014-04-07'}}$  (BOOK\_LOANS)

Bar\_S\_BOOKS\_OUT  $\leftarrow$  S\_BOOKS\_OUT  $\mid><\mid$  S\_BOOKS\_OUT.Card\_no=BARROWER.Card\_no BARROWER  
RESULT  $\leftarrow$  Bar\_S\_BOOKS\_OUT  $\mid><\mid$  Bar\_S\_BOOKS\_OUT.Book\_id=BOOK.Book\_id BOOK  
 $\pi_{\text{Name,Address,Title}}$ (RESULT)

Title	Name	Address
The Wolf	Ryan Lockman	462 South St
My Way	Ben Stills	212 N Mine St

```
SELECT * AS SHARP
FROM LIBRARY_BRANCH
WHERE Branch_Name = 'Sharpstown';
```

```
SELECT * AS S_BOOKS_OUT
FROM BOOK_LOANS
WHERE Branch_id = SHARP.Branch_id
AND
Due_date = '2014-04-07';
```

```
SELECT * AS Bar_S_BOOKS_OUT
FROM S_BOOKS_OUT
INNER JOIN BARROWER
ON S_BOOKS_OUT.Card_no = BARROWER.Card_no;
```

```
SELECT * AS RESULT
FROM BAR_S_BOOKS_OUT
INNER JOIN BOOK
ON BAR_S_BOOKS_OUT.Book_id = BOOK.Book_id;
```

```
SELECT DISTINCT RESULT.Name, RESULT.Address, RESULT.Title
FROM RESULT;
```

e.

```
LIB_OUTS ← LIBRARY_BRANCH |><| LIBRARY_BRANCH.Branch_no= BOOK_LOANS.Branch_no BOOK_LOANS
LIB_OUTS_COPIES ← LIB_OUTS |><| LIB_OUTS.Branch_no= BOOK_COPIES.Branch_no BOOK_COPIES
```

```
Branch_name ⋈ SUM No_of_copies (LIB_OUTS_COPIES)
```

```
π Branch_name,SUM_No_of_copies (LIB_OUTS_COPIES)
```

Branch_name	SUM_No_of_copies
Central	1265
Sharpstown	2364

```
SELECT * AS LIB_OUTS
FROM LIBRARY_BRANCH
INNER JOIN BOOK_LOANS
ON LIBRARY_BRANCH.Branch_no = BOOK_LOANS.Branch_no;
```

```
SELECT * AS LIB_OUTS_COPIES
FROM LIB_OUTS
INNER JOIN BOOK_COPIES
ON LIB_OUTS.Branch_no = BOOK_COPIES.Branch_no;
```

```
SELECT SUM(No_of_copies)
FROM LIB_OUTS_COPIES
GROUP BY Branch_name;
```

```
SELECT DISTINCT LIB_OUTS_COPIES.Branch_name,
                LIB_OUTS_COPIES.SUM_No_of_copies
FROM LIB_OUTS_COPIES;
```

f.

```
BAR_BOOK_OUT ← BARROWER |><| BARROWER.Card_no = BOOK_LOANS.Card_no BOOK_LOANS
Card_no ⋈ COUNT Book_id (BAR_BOOK_OUT)
```

```
BAR_MORE_5 ← O~COUNT_Book_id > 5 (BAR_BOOK_OUT)
π Name,Address,COUNT_Book_id (BAR_MORE_5)
```

Name	Address	COUNT_Book_id
Ben Small	121 S High	6
Ryan Sans	216 N Moore	9

```
SELECT * AS BAR_BOOK_OUT
FROM BARROWER
INNER JOIN BOOK_LOANS
ON BARROWER.Card_no = BOOK_LOANS.Card_no;
```

```
SELECT COUNT(Book_id)
FROM BAR_BOOK_OUT
GROUP BY Card_no;
```

```
SELECT * AS BAR_MORE_5
FROM BAR_BOOK_OUT
WHERE COUNT_Book_id > 5;
```

```
SELECT DISTINCT BAR_MORE_5.Name, BAR_MORE_5.Address,
                BAR_MORE_5.COUNT_Book_id
FROM BAR_MORE_5;
```

g.

```
KING          ← O~ Author_Name='Stephan King' (BOOK_AUTHORS)
KING_BOOKS ← KING |><| KING.Book_id=BOOK.Book_id BOOK
```

```
CENT          ← O~ Branch_Name='Central' (LIBRARY_BRANCH)
CENT_BOOKS ← CENT |><| CENT.Branch_no= BOOK_COPIES.Branch_no BOOK_COPIES
```

```
CENT_KING ← CENT_BOOKS |><| CENT_BOOKS.Book_no= KING_BOOKS.Book_no KING_BOOKS
π Title,No_of_copies (CENT_KING)
```

Title	No_of_copies
The Lost Ship	6
Stolen Art	12

```
SELECT * AS KING
FROM BOOK_AUTHORS
WHERE Author_Name = 'Stephan King';
```

```
SELECT * AS KING_BOOKS
FROM KING
INNER JOIN BOOK
ON KING.Book_id = BOOK.Book_id;
```

```
SELECT * AS CENT
FROM LIBRARY_BRANCH
WHERE Branch_Name = 'Central';
```

```
SELECT * AS CENT_BOOKS
FROM CENT
INNER JOIN BOOK_COPIES
ON CENT.Branch_no = BOOK_COPIES.Branch_no;
```

```
SELECT * AS CENT_KING
FROM CENT_BOOKS
INNER JOIN KING_BOOKS
ON CENT_BOOKS.Book_no = KING_BOOKS.Book_no;
```

```
SELECT DISTINCT CENT_KING.Title, CENT_KING.No_of_copies
FROM CENT_KING;
```

6.19

a.

```
War_2 ← O~ Warehouse# = '2' (SHIPMENT)
π Order#,Ship_date (War_2)
```

Order#	Ship_date
4213	2014-01-01
6215	2013-12-13

b.

$J\_LOPEZ \leftarrow O \sim_{Cname='Jose Lopez'} (CUSTOMER)$

$JL\_ORDERS \leftarrow ORDER \mid_{ORDER.Cust\# = J\_LOPEZ.Cust\#} J\_LOPEZ$

$JL\_SHIPMENTS \leftarrow JL\_ORDERS \mid_{JL\_ORDERS.Order\# = SHIPMENT.Order\#} SHIPMENT$

$\pi_{Order\#, Warehouse\#} (JL\_SHIPMENTS)$

Order#	Warehouse#
6251	02
1242	04

c.

$CUST\_ORDERS \leftarrow CUSTOMER \mid_{CUSTOMER.Cust\# = ORDER.Cust\#} ORDER$

$\rho R(Cname, No\_of\_orders, Avg\_order\_amount) (Cname \bowtie COUNT Order\#, AVERAGE Ord\_amt (CUST\_ORDERS))$

Cname	No_of_orders	Avg_order_amount
Ben Still	6	\$21.23
Ryan Moore	4	\$16.98

d.

$SHIP\_ORDERS \leftarrow ORDER \mid_{ORDER.Order\# = SHIPMENT.Order\#} SHIPMENT$

$OVERDUE\_ORDERS \leftarrow O \sim_{(Ship\_date - Odate) > 30} (SHIP\_ORDERS)$

Order#	Odate	Cust#	Ord_amt	Warehouse#	Ship_date
1212	2014-01-01	521	\$62.62	02	2014-02-06
6231	2014-02-01	612	\$13.23	06	2014-04-01

e.

$NEW\_YORK \leftarrow O \sim_{City='New York'} (WAREHOUSE)$

$NY\_SHIP\_ORDERS \leftarrow NEW\_YORK \mid_{NEW\_YORK.Warehouse\# = SHIPMENT.Warehouse\#} SHIPMENT$

$\pi_{Order\#} (NY\_SHIP\_ORDERS)$

Order#
3623
1731
5543