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Prof. VB

CS457

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HW 5A

Exercise 8.22

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

```
MariaDB [19610dm]> select * from T1 join T2 on T1.P = T2.A;
```

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

3 rows in set (0.000 sec)

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

```
MariaDB [19610dm]> select * from T1 join T2 on T1.Q = T2.B;
```

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

2 rows in set (0.000 sec)

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

c.

```
MariaDB [19610dm]> select * from T1 left outer join T2 on T1.P = T2.A;
```

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

```
4 rows in set (0.000 sec)
```

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

d.

```
MariaDB [19610dm]> select * from T1 right outer join T2 on T1.Q = T2.B;
```

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

```
3 rows in set (0.000 sec)
```

$$T1 \cup T2$$

e.

```
MariaDB [19610dm]> select * from T1 UNION select * from T2;
+-----+-----+-----+
| P      | Q      | R      |
+-----+-----+-----+
| 10     | a      | 5      |
| 15     | b      | 8      |
| 25     | a      | 6      |
| 10     | b      | 6      |
| 25     | c      | 3      |
| 10     | b      | 5      |
+-----+-----+-----+
6 rows in set (0.000 sec)
```

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

```
MariaDB [19610dm]> select * from T1 join T2 on T1.P = T2.A and T1.R = T2.C;
+-----+-----+-----+-----+-----+-----+
| P      | Q      | R      | A      | B      | C      |
+-----+-----+-----+-----+-----+-----+
| 10     | a      | 5      | 10     | b      | 5      |
+-----+-----+-----+-----+-----+-----+
1 row in set (0.000 sec)
```

### Exercise 8.24

(a) Retrieve the names of employees in department 5 who work more than 10 hours per week on the 'ProductX' project.

#### ***Tuple relational Calculus:***

{ e.LNAME, e.FNAME | EMPLOYEE(e) AND e.DNO=5 AND (EXISTS p) (EXISTS w)  
(WORKS\_ON(w) AND PROJECT(p) AND e.SSN=w.ESSN AND w.PNO=p.PNUMBER AND  
p.PNAME='ProductX' AND w.HOURS>10 ) }

#### ***Domain relational Calculus:***

$\{ qs \mid \text{EMPLOYEE}(qrstuvwxyz) \text{ AND } z=5 \text{ AND } (\text{EXISTS } a) (\text{EXISTS } b) (\text{EXISTS } e) (\text{EXISTS } f) (\text{EXISTS } g) ( \text{WORKS\_ON}(efg) \text{ AND } \text{PROJECT}(abcd) \text{ AND } t=e \text{ AND } f=b \text{ AND } a=\text{'ProductX'} \text{ AND } g>10 ) \}$

(b) List the names of employees who have a dependent with the same first name as themselves.

***Tuple relational Calculus:***

$\{ e.\text{LNAME}, e.\text{FNAME} \mid \text{EMPLOYEE}(e) \text{ AND } (\text{EXISTS } d) ( \text{DEPENDENT}(d) \text{ AND } e.\text{SSN}=d.\text{ESSN} \text{ AND } e.\text{FNAME}=d.\text{DEPENDENT\_NAME} ) \}$

***Domain relational Calculus:***

$\{ qs \mid (\text{EXISTS } t) (\text{EXISTS } a) (\text{EXISTS } b) ( \text{EMPLOYEE}(qrstuvwxyz) \text{ AND } \text{DEPENDENT}(abcde) \text{ AND } a=t \text{ AND } b=q ) \}$

(c) Find the names of employees that are directly supervised by 'Franklin Wong'.

***Tuple relational Calculus:***

$\{ e.\text{LNAME}, e.\text{FNAME} \mid \text{EMPLOYEE}(e) \text{ AND } (\text{EXISTS } s) ( \text{EMPLOYEE}(s) \text{ AND } s.\text{FNAME}=\text{'Franklin'} \text{ AND } s.\text{LNAME}=\text{'Wong'} \text{ AND } e.\text{SUPERSSN}=s.\text{SSN} ) \}$

***Domain relational Calculus:***

$\{ qs \mid (\text{EXISTS } y) (\text{EXISTS } a) (\text{EXISTS } c) (\text{EXISTS } d) ( \text{EMPLOYEE}(qrstuvwxyz) \text{ AND } \text{EMPLOYEE}(abcdefghij) \text{ AND } a=\text{'Franklin'} \text{ AND } c=\text{'Wong'} \text{ AND } y=d ) \}$

(e) Retrieve the names of employees who work on every project.

***Tuple relational Calculus:***

$$\{ e.LNAME, e.FNAME \mid EMPLOYEE(e) \text{ AND } (FORALL \ p) ( \text{ NOT}(\text{PROJECT}(p)) \text{ OR } (\text{EXISTS } w) (\text{WORKS\_ON}(w) \text{ AND } p.PNUMBER=w.PNO \text{ AND } w.ESSN=e.SSN ) ) \}$$

**Domain relational Calculus:**

$$\{ qs \mid (\text{EXISTS } t) ( EMPLOYEE(qrstuvwxyz) \text{ AND } (FORALL \ b) (\text{ NOT}(\text{PROJECT}(abcd)) \text{ OR } (\text{EXISTS } e) (\text{EXISTS } f) (\text{WORKS\_ON}(efg) \text{ AND } e=t \text{ AND } f=b) ) ) \}$$

(f) Retrieve the names of employees who do not work on any project.

**Tuple relational Calculus:**

$$\{ e.LNAME, e.FNAME \mid EMPLOYEE(e) \text{ AND } \text{ NOT}(\text{EXISTS } w) ( \text{ WORKS\_ON}(w) \text{ AND } w.ESSN=e.SSN ) \}$$

**Domain relational Calculus:**

$$\{ qs \mid (\text{EXISTS } t) ( EMPLOYEE(qrstuvwxyz) \text{ AND } \text{ NOT}(\text{EXISTS } a) (\text{WORKS\_ON}(abc) \text{ AND } a=t) ) \}$$

(i) Find the names and addresses of employees who work on at least one project located in Houston but whose department has no location in Houston.

**Tuple relational Calculus:**

$$\{ e.LNAME, e.FNAME, e.ADDRESS \mid EMPLOYEE(e) \text{ AND } (\text{EXISTS } p) (\text{EXISTS } w) (\text{WORKS\_ON}(w) \text{ AND } \text{PROJECT}(p) \text{ AND } e.SSN=w.ESSN \text{ AND } w.PNO=p.PNUMBER \text{ AND } p.PLOCATION='Houston' \text{ AND } \text{ NOT}(\text{EXISTS } l) ( \text{ DEPT\_LOCATIONS}(l) \text{ AND } e.DNO=l.DNUMBER \text{ AND } l.DLOCATION='Houston' ) ) \}$$

**Domain relational Calculus:**

$$\{ qsv \mid (\text{EXISTS } t) (\text{EXISTS } z) ( \text{EMPLOYEE}(qrstuvwxyz) \text{ AND } (\text{EXISTS } b) (\text{EXISTS } c) (\text{EXISTS } e) (\text{EXISTS } f) ( \text{WORKS\_ON}(efg) \text{ AND } \text{PROJECT}(abcd) \text{ AND } t=e \text{ AND } f=b \text{ AND } c='Houston' \text{ AND } \text{NOT}(\text{EXISTS } h) \text{ NOT}(\text{EXISTS } i) ( \text{DEPT\_LOCATIONS}(hi) \text{ AND } z=h \text{ AND } i='Houston') ) ) \}$$

(j) List the last names of department managers who have no dependents.

***Tuple relational Calculus:***

$$\{ e.LNAME \mid \text{EMPLOYEE}(e) \text{ AND } (\text{EXISTS } d) ( \text{DEPARTMENT}(d) \text{ AND } e.SSN=d.MGRSSN \text{ AND } \text{NOT}(\text{EXISTS } x) (\text{DEPENDENT}(x) \text{ AND } e.SSN=x.ESSN) ) \}$$

***Domain relational Calculus:***

$$\{ s \mid (\text{EXISTS } t) ( \text{EMPLOYEE}(qrstuvwxyz) \text{ AND } (\text{EXISTS } c) ( \text{DEPARTMENT}(abcd) \text{ AND } t=c \text{ AND } \text{NOT}(\text{EXISTS } e) (\text{DEPENDENT}(efghi) \text{ AND } e=t) ) ) \}$$

### **Exercise 8.26**

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

***Tuple relational Calculus:***

$$\{ b.Name \mid \text{BORROWER}(b) \text{ and not}(\exists l) (\text{Book\_loans}(l) \text{ AND } b.Card\_no = l.Card\_no) \}$$

***Domain relational Calculus:***

$$\{ q \mid (\exists z) (\text{Borrower}(qrstuvwxyz) \text{ AND } \text{Book\_loans}(lmno) \text{ AND } m = z \}$$

(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.

***Tuple relational Calculus:***

$\{ a.Title, b.Name, b.Address \mid Book(a) \wedge Borrower(b) \wedge ((\exists c) (Book\_loans(c) \wedge (\exists d)(Library\_branch(d) \wedge d.Branch\_name = 'Sharptown' \wedge d.Branch\_id = c.Branch\_id \wedge c.Due\_date = 'today' \wedge c.Card\_no = b.Card\_no \wedge c.Book\_id = a.Book\_id) \wedge c.Due\_date = 'today' \wedge c.Card\_no = b.Card\_no \wedge c.Book\_id = a.Book\_id) \}$

***Domain relational Calculus:***

$\{ a,e,f \mid (\exists b)(\exists c)(\exists d)(\exists n)(\exists m)(\exists j)(\exists i)$   
 $Book(abcd) \wedge Borrower(efgh)$   
 $\wedge Book\_loans(ijklm) \wedge Library\_branch(nop)$   
 $\wedge p = 'Sharptown' \wedge i = o \wedge j = f \}$

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

***Tuple relational Calculus:***

$\{ b.Name, b.Address, count(a) \mid Book\_loans(a) \wedge Borrower(b)$   
 $\wedge b.Card\_no = a.Card\_no \wedge count(b) > 5 \}$

***Domain relational Calculus:***

$\{ q,s,v \mid (\exists z)(\exists l)(\exists m)(Borrower(qrstuvwxyz)$   
 $\wedge m = z \wedge count > 5 \}$