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Assignment 2 - Part 1

Relational Algebra

1. $\pi_{\{cid,name,email,address,phone,stuno\}}(Customers \bowtie_{\{cid\}} Students)$

2. $\pi_{\{name,empno,address\}}\sigma_{\{local=<null>\}}(Customers \bowtie_{\{cid\}} Employees)$

3. $\pi_{\{startTime,expireTime,name\}}(Permits \bowtie_{\{owner=cid\}} Customers)$

4. $\pi_{\{cid,name\}}(Customers \bowtie_{\{cid=owner\}} Permits)$

5. $\pi_{\{startTime,purchaseTime,name\}}\sigma_{\{expireTime >= '2019\text{-}06\text{-}30'\}}(Customers \bowtie_{\{cid=owner\}} Permits)$

6. $\pi_{\{name,email\}}(Customers) - \pi_{\{name,email\}}(Customers \bowtie_{\{cid=owner\}} Permits)$

7. $\pi_{\{name,email\}}(Customers \bowtie_{\{cid=owner\}} Permits)$
   $- \pi_{\{name,email\}}(Customers \bowtie_{\{cid=owner\}} (Permits \bowtie_{\{pid\}} Registration))$

8. $\pi_{\{plate,ticketTime,violation\}}\sigma_{\{fine > paidAmount\ OR\ (fine > 0\ AND\ paidAmount = <null>)\}}(Tickets)$

9. $\pi_{\{name\}} - \pi_{\{name\}}\sigma_{\{ticketTime >= startTime\ AND\ ticketTime <= expireTime\}}($
   $Customers \bowtie_{\{cid=owner\}} (Permits \bowtie_{\{pid\}} (Registration \bowtie_{\{plate\}} Tickets)))$

10. $\pi_{\{name\}}\Big(\pi_{\{name,cid\}}(Customers)$
    $- \pi_{\{name,cid\}}(Customers \bowtie_{\{cid=owner\}}$
    $(\pi_{\{owner\}}(Permits \bowtie_{\{pid\}} (\pi_{\{pid\}}\sigma_{\{count(pid) > 1\}}\gamma_{\{pid,count(pid)\}}($
    $Permits \bowtie_{\{pid\}} Registration)))$
    $\cup (\pi_{\{owner\}}(Permits) - \pi_{\{owner\}}(Permits \bowtie_{\{pid\}} Registration)))))\Big)$

Datalog

1.
```
R1(cid, name, email, address, phone, stuno):-
    Students(cid,stuno)
and Customers(cid, name, email, address, phone);
```

2.
```
R2(name, empno, address):-
    Employees(cid, empno, N)
and N is null
and Customers(cid, name,__, address,__);
```

3.
```
R3(startTime, expireTime, name):-
    Permits(__, startTime, expireTime, owner,__)
and Customers(owner, name,__,__,__);
```

4.
```
R4(cid, name):-
    Customers(cid, name,__,__,__)
and Permits(__,__,__, cid,__);
```

5.
```
R5(startTime, purchaseTime, name):-
    Permits(__, startTime, exprieTime, owner, purchaseTime)
and Customers(owner, name,__,__,__)
and expireTime >= '2019-06-30';
```

6.
```
R6(name, email):-
    Customers(cid, name, email,__,__)
and ¬ Permits(__,__,__, cid,__);
```

7.
```
R7(name, email):-
    Customers(cid, name, email,__,__)
and Permits(pid,__,__, cid,__)
and ¬ Registration(__, pid);
```

8.
```
R8(plate, ticketTime, violation):-
    Tickets(__, plate, ticketTime,__, violation, fine, paidAmount)
and (fine > paidAmount
     or (fine > 0
         and paidAmount is null));
```

9.
```
R9(name):-
    Customers(cid, name,__,__,__)
and ¬(Permits(pid,__,__, cid,__)
      and Registration(plate, pid)
      and Tickets(__, plate,__,__,__,__,__));
```

10.
```
R10(name):-
    Customers(cid, name,__,__,__)
and ¬((Permits(pid,__,__, cid,__)
       and ¬(Redistration(__,pid))
      or (Permits(pid,__,__, cid,__)
          and Registration(A, pid)
          and Registration(B, pid)
          and A != B));
```