# CS 432 Fall 2007 – SQL and Relational Algebra/Calculus Exercises

Sailor(sid, sname, rating, age)

Reserves(sid, bid, date)

Boat(bid, bname, color)

Return the sids of sailors who have sailed only (=nothing but) red boats.

```
(select S.sid from Sailors S)
except
(select sid from Reserves R, Boat B where
  R.bid=B.bid and B.color != 'red');
```

Sailor(sid, sname, rating, age)

Reserves(sid, bid, date)

Boat(bid, bname, color)

Return, for each sailor, her/his sid and the number of reservations s/he has made.

```
select sid, count(bid)
from Sailors S outer join Reserves R on
    (S.sid=R.sid)
group by sid;
```

Sailor(sid, sname, rating, age)

Reserves(sid, bid, date)

Boat(bid, bname, color)

Return, for each sailor, the sid and the number of distinct boats s/he has sailed in.

```
select sid, count(distinct bid)
from Sailors S outer join Reserves R on
  (S.sid=R.sid)
group by sid;
```

Sailor(sid, sname, rating, age)

Reserves(sid, bid, date)

Boat(bid, bname, color)

Return, for each boat (bid), the age of the oldest sailor who has sailed in it. (in relational calculus)

Phi := { (x5, x4) | exists x1, x2, x3, x6: (x1, x2, x3, x4) in Sailors and (x1, x5, x6) in Reserves }

{(x,y) | (x, y) in Phi and not exists y': (x,y') in Phi and y' > y}

or

{(x,y) | (exists x1, x2, x3, x6: (x1, x2, x3, y) in Sailors and (x1, x, x6) in Reserves) and not exists y': (exists x1, x2, x3, x6: (x1, x2, x3, y') in Sailors and (x1, x, x6) in Reserves) and y' > y}

Sailor(sid, sname, rating, age)
Reserves(sid, bid, date)
Boat(bid, bname, color)

Return, for each boat (bid), the age of the oldest sailor who
    has sailed in it. (in relational algebra)

Phi := Project[bid, age](Sailors bowtie Reserves)

{(x,y) | (x, y) in Phi and not exists y': (x,y') in Phi and y' > y}

Phi – project[bid, age1](
    rho(P1, rho(age->age1,Phi))
        bowtie_[P1.bid=P2.bid and P1.age1 < P2.age2]
    rho(P2, rho(age->age2, Phi)))

Sailor(sid, sname, rating, age)

Reserves(sid, bid, date)

Boat(bid, bname, color)

Compute the sids of sailors who have sailed in boats of every color.

project[sid,color](Reserves bowtie Boat) / project[color](Boat)