UMass Lowell
Department of Computer Science
Fall 2017

Instructor: Prof. Chen

COMP.5730 Midterm Exam
Closed Book, 2 Hours
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Problem	Score	
1	(35%)	35
2	(65%)	44+5 49
Total	(100%)	79+5 84

NOTE: Write clearly — if your handwriting can not be read easily, your exam will not be graded.

Use the following relations about sailors and boats for Problems 1 and 2.

```
sailors (sid, sname, age, rating)
boats (bid, bname, color)
reserve (sid, bid, date)
```

(NOTE: sname and bname may not be unique.)

Problem 1

(7 points each question)

Express the following queries in Relational Algebra.

1. Find the names of red boats.

$\Pi_{bname}(\sigma_{color='red'}(boats))$

2. Find the names of sailors who have reserved a red boat.

$\Pi_{sname}(\sigma_{boat.color='red'}(sailors \bowtie reserve \bowtie boats))$

3. Find the names of sailors who have reserved a red boat and a green boat.

$r \leftarrow \Pi_{sname}(\sigma_{boats.color='red'}(sailors \bowtie reserve \bowtie boats))$

$g \leftarrow \Pi_{sname}(\sigma_{boats.color='green'}(sailors \bowtie reserve \bowtie boats))$

$result \leftarrow r \cap g$

4. Find the names of sailors who have reserved exactly one boat.

$at\_least\_one \leftarrow \Pi_{sname}(sailors \bowtie reserve)$

$at\_least\_two \leftarrow \Pi_{sname}(sailors \bowtie (\Pi_{r_1.sid}(\sigma_{r_1.sid = r_2.sid \wedge r_1.bid \neq r_2.bid}(\rho_{r_1}reserve \times \rho_{r_2}reserve))))$

$exactly\_one \leftarrow at\_least\_one - at\_least\_two$

Answer 5

$$R1 \leftarrow \Pi_{sid, bid}(sailors \times \sigma_{color='red'}(boats)) \cup \Pi_{sid, bid}(sailors \times \sigma_{color='green'}(boats))$$

$$R2 \leftarrow R1 - \Pi_{sid, bid}(reserves)$$

$$result \leftarrow \Pi_{sname}(sailors \bowtie (\Pi_{sid} sailors - \Pi_{sid} R2))$$

5. Find the names of sailors who have reserved all the red and green boats.

All_red_boat $\leftarrow \Pi_{bid}(\sigma_{color='red'}(boats))$

ID_reserve $\leftarrow \Pi_{sid}(reserve)$

$T_1 \leftarrow$ All_red_boat $\times$ ID_reserve

$T_2 \leftarrow T_1 - reserve$

* Sailor_all_red $\leftarrow \Pi_{sname}(sailer \bowtie (ID\_reserve - T_2))$

All_green_boat $\leftarrow \Pi_{bid}(\sigma_{color='green'}(boats))$

$T_3 \leftarrow$ All_green_boat $\times$ ID_reserve.

$T_4 \leftarrow T_3 - reserve$

* Sailor_all_green $\leftarrow \Pi_{sname}(sailer \bowtie (ID\_reserve - T_4))$

All_green_and_red $\leftarrow$ sailor_all_red $\cap$ sailor_all_green.

Problem 2

(6 points each for the first five questions; 7 points each for the last five questions)

Express the following queries in SQL. (Only standard SQL syntax is allowed. Each query should be answered in a single SQL statement.)

1. Find the names of red boats.

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```
Select bname
from boats
where color = 'red';
```

2. Find the names of sailors who have reserved a red boat.

6

```
Select distinct S.sname
from   sailors as S, boats as B, reserve as R
where  B.color = 'red';
```

✓

3. Find the names of sailors who have reserved a red boat and a green boat.

```
Select  distinct  S.sname
from    sailors as S,  boats as B ,  reserve as R
where   B.color = 'red'  and  B.color = 'green' )
```

```
Select sname
from sailors
where sid in (select sid
              from reserves
              Minus
              select R1.sid
              from reserve R1, reserve R2
              where R1.sid = R2.sid and R1.bid <> R2.bid
```

4. Find the names of sailors who have reserved exactly one boat.

```
Select  distinct  S.sname
from    Sailors as S, reserve as R
where   count(R.sid) = 1;
```

5. Find the names of sailors who have reserved all the red and green boats.

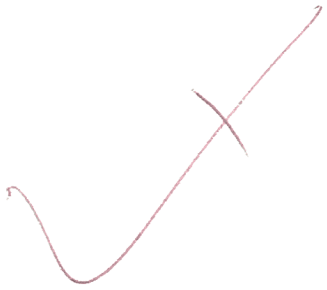
```
with all_red_boat as
   (select bid from boats where color = 'red')
with ID_reserve as
   (select sid from reserve)
with T1 as
   (select sid, bid from all_red_boat, ID_reserve)
with T2 as
   (select sid from reserve
      where sid not in (select R.sid
                        from T1 outter join Reserve on
                           T1.sid = Reserve.sid,
                           T1.bid = Reserve.bid'))

with sailer_all_red as
   (select S.sname
    from Sailer as S, (select ID.sid
                       from ID_reserve as ID,
                       where ID.sid not in (select T2.sid
                                            from T2)))
with all_green_boat as
   (select bid from boat where color = 'green')
with T3 as
   (select sid, bid from all_green_boat, ID_reserve)
with T4 as
   (select sid from reserve
      where sid not in (select R.sid
                        from T3 outter join Reserve on
                           T3.sid = Reserve.sid
                           T3.bid = Reserve.bid)
with sailer_all_green boat as
   (select S1.name. from Sailer as S1, (selut ID1.sid
                                        from ID_reserve as ID1,
                                        where ID1.sid not in
                                           (selut T4.sid from T4)
```

→ continue next page

```
(select Result.sname
 from sailor_all red as Result1 INNER JOIN sailor_all green as Result2
      on Result.sname = Result2.sname );
```

* // code based on Relational Algebra *



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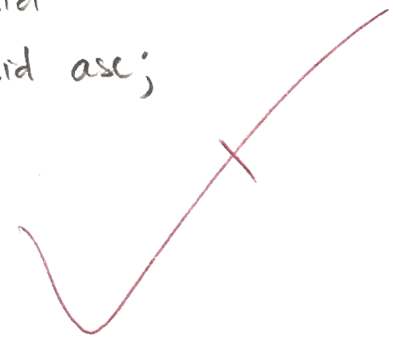
6. Count how many unique boats each sailor has reserved. List the result in ascending order of sailors' IDs.

```
Select  count(R.bid) , Sid.
from    reserve  R
group   by R.sid
order   by R.sid asc;
```



7. Find the names of boats that have been reserved more frequently than the boat named Interlake.

```
select distinct B1.bname.
from   boats as B1, reserve as R1
where  count(R1.bid) > (select count(R2.bid)
                        from boats as B2, reserve as R2
                        where B2.name = 'Interlake');
```

8. Find the average age of the rating group if the group has the youngest sailor of all sailors.

```
Select  avg(age)
from    sailors as S, (select rating
                       from sailor as S2
                       where age <= all (select age
                                         from sailors)) as youngest
where   S.rating = Youngest.rating;
```

get the rating of the youngest.

get all row of have the same rating of the youyest.

9. Find the names and ratings of sailors who have reserved the most number of unique boats.

```
with take as
    (select distinct sid, distinct bid
     from reserve )

Select S.sname , S.rating
from   Sailors as S ,
       (select T1.sid
        from   take as T1
        where  count( T1.bid ) >= all (select count(T2.bid)
                                       from take as T2
                                       group by T2.sid ))as R1

where S.sid = R1.sid
```

// remove date, get only distinct value from sid and bid.

10. For sailors in the rating group that reserve boats the most often, find how many times each sailor reserves boats.

Select count (bid) > all xlet

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