Database Management Systems

Query Examples

Sample Database Schema

- Schema
    - Sailors (sid, sname, rating, age)
    - Boats (bid, bname, color, builtYear)
    - Reservations (sid, bid, rdate)
- Relational Algebra Legend
    - S_(cond) Relation -- selection (sigma) operation
    - P_{columns} Relation -- projection (pi) operation
    - R_(nr(ncolumn)) Relation -- renaming (rou) operation
    - Relation1 J_(cond) Relation2 -- join operation

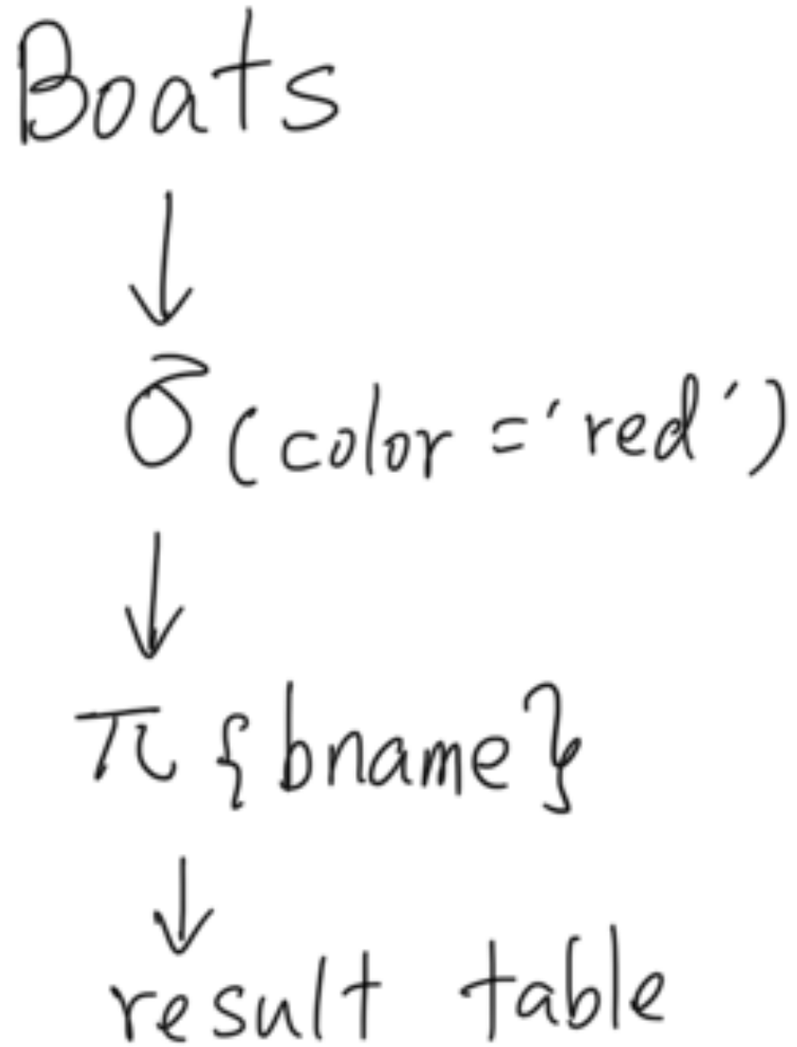
Example 1

- List name of each red boat

- select bname
  from boats
  where color = ‘red’;

- Result(bn) ::=
  Boats(_, bn, ‘red’, _)

- P_{bname}
  (S_(color=‘red’) boats)



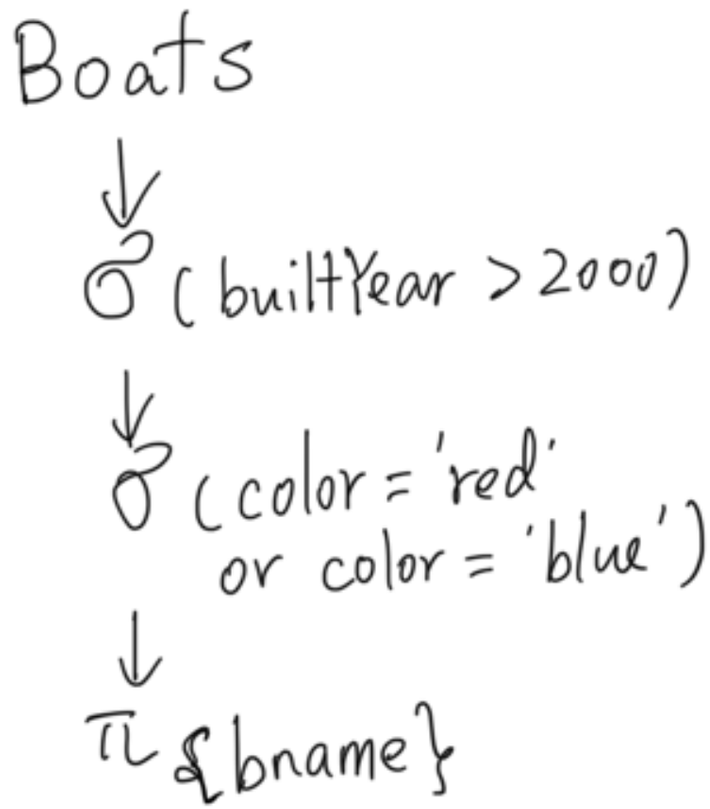
Example 2

- List name of each boat that is either red or blue, and is built after year 2000.

- select bname
  from boats
  where builtYear > 2000
    and (color = ‘red’ or color = ‘blue’);

- Result(bn) ::= Boats(_, bn, c, y)
    and (c = ‘red’ or c = ‘blue’)
    and y > 2000

- P_{bname}
    (S_((color = ‘red’ or color = ‘blue’)
        and builtYear > 2000) Boats)



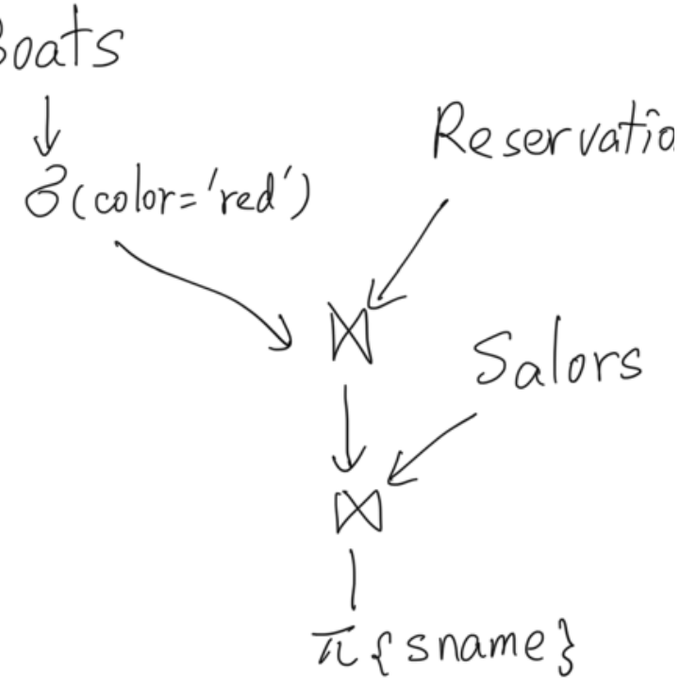
Example 3

- List name of each sailor who reserved some red boats.

- select distinct sname
  from Sailors natural join Reservations
  natural join Boats
  where color = ‘red’;

- Result(sn) ::= Sailors(s, sn, _, _)
  and Boats(b, _, ‘red’, _)
  and Reservations(s, b, _)

- P_{sname} ((S_(color=‘red’) Boats)
  J Reservations J Sailors)



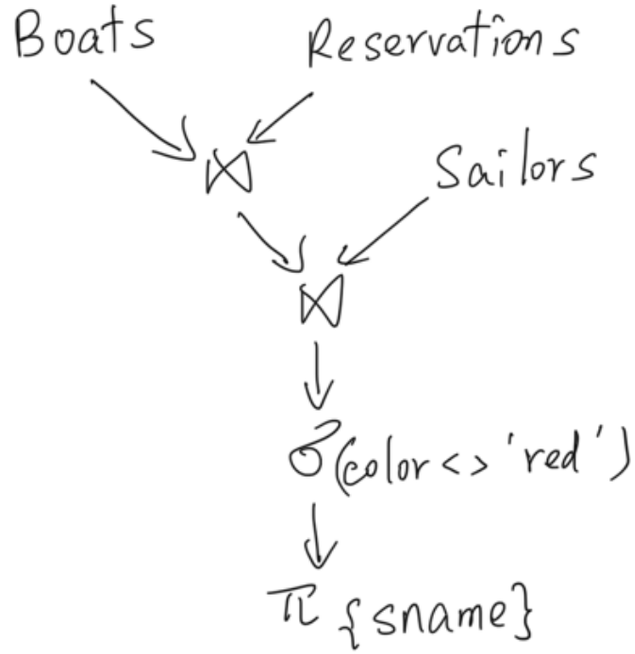
Example 4

- List name of each sailor who reserved some boats that are not red.

- select distinct sname
  from Sailors natural join Reservations
  natural join Boats
  where color <> ‘red’;

- Result(sn) ::= Sailors(s, sn, _, _)
  and Boats(b, _, c, _)
  and Reservations(s, b, _)
  and c <> ‘red’

- P_{sname} (S_(color<>’red’)
  ((Boats J Reservations) J Sailors))



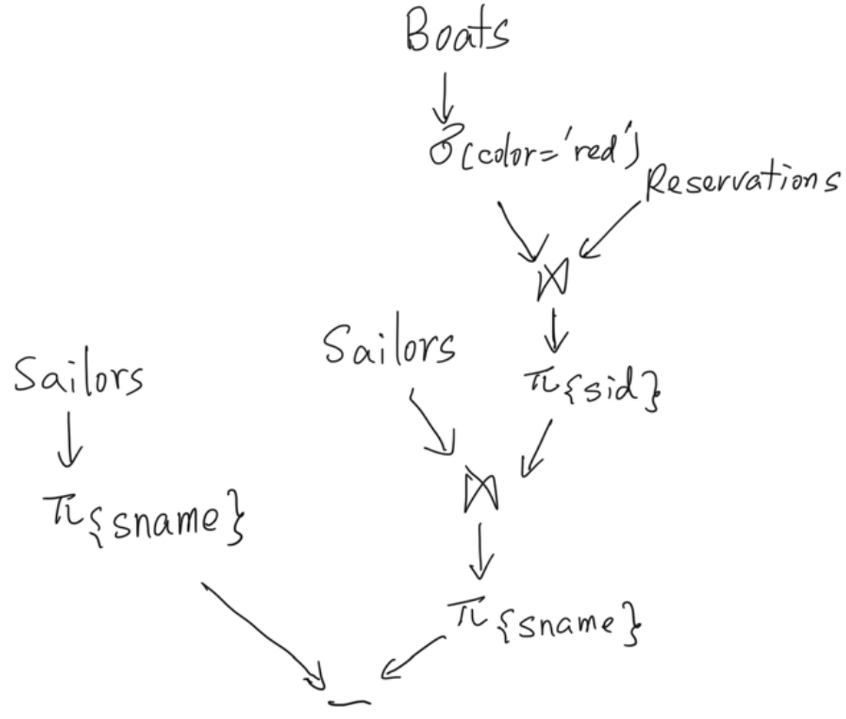
Example 5

- List name of each sailor who never reserved any red boats.

- select sname
  from Sailors
  where sid NOT IN
    (select sid
     from Reservations natural join Boats
     where color = ‘red’);

- Result(sn) ::= Sailors(s, sn, _, _)
    and not (Boats(b, _, ‘red’, _)
            and Reservations(s, b, _))

- (P_{sname} Sailors)
  -
  (P_{sname} (Sailors
    J P_{sid} (Reservation J S_(color=‘red’) Boats)))



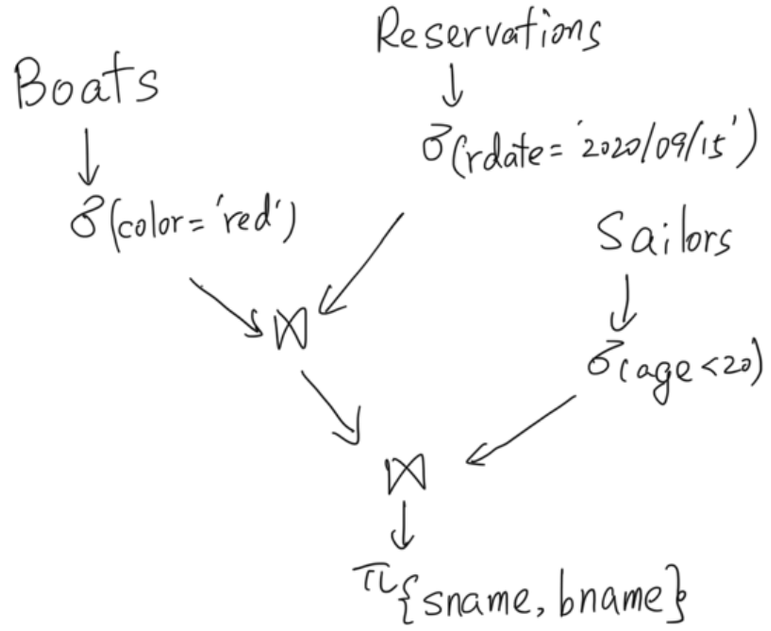
Example 6

- For each reservation made for a red boat by a sailor who is under 20, on 2020/09/15, list the name of the sailor and the name of the boat involved in this reservation.

- select sname, bname
  from Sailors natural join Reservations
  natural join Boats
  where age < 20 and color = ‘red’
  and rdate = ‘2020/09/15’;

- Result(sn, bn) ::= Sailors(s, sn, _, a)
  and Boats(b, bn, ‘red’, _)
  and Reservations(s, b, ‘2020/09/15’)
  and a < 20

- P_{sname, bname} (S_(color=‘red’) Boats J
  S_(rdate=‘2020/09/15’) Reservations
  J S_(age < 20) Sailors)



Example 7

- List name of each sailor who reserved every red boat at least once.

- select sname
  from Sailors S
  where not exists (select *
  from Boats B
  where B.color = ‘red’
  and not exists (select *
  from Reservations R
  where R.sid = S.sid
  and R.bid = B.bid));

- Result(sn) ::= Sailors(s, sn, _, _)
  and (∀ b, Boats(b, _, ‘red’, _) => Reservations(s, b, _))

Example 8

- List the names of the sailor pair who reserved the same boats.

- ```
  select S1.sname, S2.sname
  from   Sailors S1, Sailors S2
  where S1.sid < S2.sid and not exists
                  (select *
                    from Reservations R1
                    where R1.sid = S1.sid
                          and R1.bid not in (select R2.bid
                                             from Reservations R2
                                             where R2.sid = S2.sid))
          and not exists (select *
                          from Reservations R1
                          where R1.sid = S2.sid
                             and R1.bid not in (select R2.bid
                                                from Reservations R2
                                                where R2.sid = S1.sid));
  ```

- Result(sn1, sn2) ::= Sailors(s1, sn1, _, _) and Sailors(s2, sn2, _, _)
  and (∀ b, Reservations(s1, b, _) <=> Reservations(s2, b, _))
  ```

Example 9

- List name of each red boat and how many times it’s reserved.

- select bname, count(sid)
  from Boats B left join Reservations R on B.bid = R.bid
  where color = ‘red’
  group by bname;

Example 10

- List name of the boat that's reserved most. (If there are multiple boats that are reserved equally the most, list them all.)

- select bname
  from Boats natural join Reservations
  group by bid, bname
  having count(*) >= all (select count(*)
  from Reservations
  group by bid);

Example 11

- For each sailor, list his/her name and the name of the boat that's reserved the most by this sailor.

- select sname, bname
  from (select sid, sname, bid, bname, count(*) as resCount
  from Reservations natural join Sailors
  natural join Boats
  group by sid, sname, bid, bname) X,
  (select sid, max(bCount) as maxCount
  from (select sid, bid, count(*) as bCount)
  from Reservations
  group by sid, bid)) Y
  where X.sid = Y.sid and resCount >= maxCount;