Let $R(A,B,C)$ and $S(D,E,F)$ be two union compatible relation schemas. Convert the following algebra expressions to SQL (for simplicity, you can omit distinct):

\[ \pi_A(R) \]
- `select A from R`

\[ \sigma_{C=12}(R) \]
- `select * from R`
  `where C=12`

\[ \pi_{A,F}(R \text{ JOIN} \pi_{C=D}(S)) \]
- `select A, F from R, S`
  `where C=D`

\[ \pi_A(R) - \pi_D(S) \]
- `select A from R`
  `except`
  `select D from S`
Sailors (sid, sname, rating, age),
Reserves (sid, bid, date),
Boats (bid, bname, color)

<table>
<thead>
<tr>
<th>sid</th>
<th>sname</th>
<th>rating</th>
<th>age</th>
</tr>
</thead>
<tbody>
<tr>
<td>22</td>
<td>dustin</td>
<td>7</td>
<td>45.0</td>
</tr>
<tr>
<td>31</td>
<td>lubber</td>
<td>8</td>
<td>55.5</td>
</tr>
<tr>
<td>58</td>
<td>rusty</td>
<td>10</td>
<td>35.0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>sid</th>
<th>bid</th>
<th>day</th>
</tr>
</thead>
<tbody>
<tr>
<td>22</td>
<td>101</td>
<td>10/10/96</td>
</tr>
<tr>
<td>58</td>
<td>103</td>
<td>11/12/96</td>
</tr>
</tbody>
</table>
Exercise #2 – Q1

Q1: Find the names of sailors who reserved bid=103

```
select  S.sname
from    Sailors as S, Reserves as R
where   S.sid=R.sid and R.bid=103
```
Q2: Find the sid’s of sailors who reserved a red or a green boat

Solution #1

```sql
select R.sid
from Boats as B, Reserves as R
where R.bid=B.bid
  and (B.color='red' or B.color='green')
```

Solution #2

```sql
select R.sid
from Boats as B, Reserves as R
where R.bid=B.bid and B.color='red'
union
select R.sid
from Boats as B, Reserves as R
where R.bid=B.bid and B.color='green'
```

- What do we get if we replace or by and in the first solution?
- What do we get if we replace union by except in the second solution?
Q3: Find the sid’s of sailors who reserved a red and a green boat

Solution #1

```sql
select S.sid
from Sailors as S, Boats as B1, Reserves as R1,
    Boats as B2, Reserves as R2
where S.sid=R1.sid and R1.bid=B1.bid
    and B1.color='red' and S.sid=R2.sid
    and R2.bid=B2.bid and B2.color='green'
```

Solution #2

```sql
select S.sid
from Sailors as S, Boats as B, Reserves as R
where S.sid=R.sid and R.bid=B.bid and B.color='red'
intersect
select S.sid
from Sailors as S, Boats as B, Reserves as R
where S.sid=R.sid and R.bid=B.bid and B.color='green'
```

What if instead of the sid we want the sname? Would the queries be correct if we replace S.sid with S.sname in select?
Q4: Find the names of sailors who have not reserved bid=103

```
select S.sname
from Sailors as S
where S.sid not in ( select R.sid
                    from Reserves as R
                    where R.bid=103)
```
Q5: Find the names of sailors who have reserved a red boat (you must use in)

```
select S.sname
from Sailors as S
where S.sid in (select R.sid
                 from Reserves as R
                 where R.bid in (select B.bid
                                  from Boats as B
                                  where B.color=red))
```

- What if we replace the first `in` with `not in`?
- What if we replace the second `in` with `not in`?
- What if we replace both `in` with `not in`?
Q6: Find the names of sailors who have reserved bid=103 (you must use exists)

```sql
select S.sname
from Sailors as S
where exists ( select *
    from Reserves as R
    where R.bid=103 and S.sid=R.sid)
```

• What if we replace exists with not exists?
• What if we replace exists with unique?

Sailors(sid, sname, rating, age)
Reserves (sid, bid, date),
Boats (bid, bname, color)
Q7: Find the record of the sailor with the highest rating

```
SELECT * FROM Sailors AS S
WHERE S.rating >= ALL (SELECT S2.rating FROM Sailors AS S2)
```

• What if we replace all with some?

Sailors (sid, sname, rating, age)
Reserves (sid, bid, date),
Boats (bid, bname, color)
Exercise #2 – Q8

Q8: Find the names of sailors who reserved all boats

```
select S.sname 
from Sailors as S 
where not exists 
    ((select B.bid 
      from Boats as B) 
    except 
    (select R.bid 
      from Reserves as R 
      where R.sid=S.sid))
```