1. Suppose we have a table called Runnymede with the following content:

```
  name | age | grade
----------+-----+-------
  diane  | | 8
  will   | | 8
  cate   | | 1
  tom    | |
  micah  | | 1
  jamieson | | 2
```

What is the output of each query below?

(a) `select min(grade), max(grade), sum(grade), avg(grade), count(grade), count(*)` from Runnymede;

(b) `select min(age), max(age), sum(age), avg(age), count(age), count(*)` from Runnymede;

Solution:

```
csc343h-bogdan=> select min(grade), max(grade), sum(grade), avg(grade),
csc343h-bogdan-> count(grade), count(*)
csc343h-bogdan-> from Runnymede;
   min | max | sum | avg | count | count
----------+-----+-----+-----+-------+-------
     1 |  8  | 20  |  4.0000000000000000 |  5  |  6
```

```
csc343h-bogdan=> select min(age), max(age), sum(age), avg(age),
csc343h-bogdan-> count(age), count(*)
csc343h-bogdan-> from Runnymede;
   min | max | sum | avg | count | count
----------+-----+-----+-----+-------+-------
 |   |   |   |   |  6
```

Aggregation ignores nulls. Notice that count(age) can report a value even though there is nothing but nulls in the age column.

2. We have tables $R$ and $T$. Their contents are shown below.

```
  R     T
  a | b     b | c
```
What is the result of this query:

select * from R natural join T;

Solution:

csc343h-bogdan=> select * from R natural join T;

<table>
<thead>
<tr>
<th>b</th>
<th>a</th>
<th>c</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>9</td>
</tr>
<tr>
<td>6</td>
<td></td>
<td>88</td>
</tr>
</tbody>
</table>

(3 rows)

Why are tuples (5, null) and (null, 18) excluded from the result, yet tuples (null, 6) and (6, 88) are included? (null, 6) and (6, 88) are included because we are comparing on attribute b, which is 6 for both of these tuples, not null.

3. Suppose we have this table:

create table names(first text, last text, unique (first, last));

What will the result of the following be?

(a) Doing this twice: insert into names values ('Diane', 'Horton');
(b) Doing this twice: insert into names values (null, 'Liu');

Solution:

csc343h-bogdan=> insert into names values ('Diane', 'Horton');

INSERT 0 1

csc343h-bogdan=> insert into names values ('Diane', 'Horton');

ERROR: duplicate key value violates unique constraint "names_pkey"
DETAIL: Key (first, last)=(Diane, Horton) already exists.

csc343h-bogdan=> insert into names values (null, 'Liu');

INSERT 0 1

csc343h-bogdan=> insert into names values (null, 'Liu');

INSERT 0 1

csc343h-bogdan=> select * from names;

<table>
<thead>
<tr>
<th>first</th>
<th>last</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Liu</td>
</tr>
<tr>
<td></td>
<td>Liu</td>
</tr>
</tbody>
</table>

(2 rows)
The unique constraint will not allow two tuples with the same values for first and last. But in this context, two null values are considered to be different.

4. Suppose we have these tables:

```
csc343h-bogdan=> select * from R;
a | b
---+---
1 | 2
8 | 7
5 | 6
   6
(4 rows)
csc343h-bogdan=> select * from S;
a | b
---+---
3 | 4
8 | 7
5 | 6
   6
(4 rows)
```

What will the result of the following be?

(a) (SELECT * from R) INTERSECT (SELECT * from S);
(b) (SELECT * from R) EXCEPT (SELECT * from S);

```
 a | b
---+---
 5 | 6
 8 | 7
 6
(3 rows)
```

Since (5, null) appears in intersection, as does (null, 6), we infer that the two nulls are considered to be equal in this context.

5. a | b
---+
1 | 2
   6
(1 row)

Ditto, (5, null) and (null, 6) don’t appear in the set difference, implying that two nulls are considered to be equal for set operations.

**Moral of the story**

And the moral of this story is that you can never be too careful with null. It’s extremely difficult to remember what exactly its impact will be in different contexts. Even when you have code you are confident in, never assume it will behave the same way in another DBMS.