1. **Question:**
How do you define an intersection of two union-compatible relations R and S using a difference operator? (Intersection only contains tuples which occur in both relations.)

**Answer:**

\[ R \cap S = R - (R - S) \] (subtract from R all rows which are in R but not in S. Then you are left with just the rows which are both in R and in S).

2. **Question:** Write a relational algebra expression which finds names of all people who do not have the same telephone as Bob, given relation R below:

<table>
<thead>
<tr>
<th>Name</th>
<th>Tel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anne</td>
<td>111111</td>
</tr>
<tr>
<td>Bob</td>
<td>222222</td>
</tr>
<tr>
<td>Chris</td>
<td>333333</td>
</tr>
<tr>
<td>Dan</td>
<td>111111</td>
</tr>
</tbody>
</table>

**Answer:**

Sorry, this turned out to be a more complicated question than I intended. I did not mean something like

\[ \pi_{Name} \sigma_{Tel \neq 222222} (R) \]

(although if you answered that it’s OK: this is the right level of difficulty I should have set for a sample exam question).

The original question was to write a query which will work whatever Bob’s telephone is. To do this we need to take a product of R with itself, but I did not tell you how to distinguish columns in the product (it will have two Name columns and two Tel products). Below I denote the second Name column Name1 and the second Tel column Tel1. There is actually a special relational algebra operation for this, called renaming, which is needed when columns have names and not just numbers.

So, to find the names of people with different number from Bob, consider the following relations:

- \( R1 = \pi_{Name} \sigma_{(Name = Bob) \ AND \ (Tel = Tel1)} (R \times R) \). This defines the names of people who DO have the same telephone as Bob.
- \( \pi_{Name}(R) - R1 \) this subtracts the names of people who have the same telephone number as Bob from the list of all names in R, so you will be left with a list of people who do not have the same number as Bob.

So the answer is:

\[ \pi_{Name}(R) - \pi_{Name} \sigma_{(Name = Bob) \ AND \ (Tel = Tel1)} (R \times R) \]