DBS Tutorial

Question 1. Consider the following two relations:

R:

A	B
1	2
1	0
3	4

S:

B	C
2	7
2	5
0	4
3	4

For each query below, compute its result on the above database.

a) Query 1.

```
SELECT T.A, COUNT (T.D)
FROM (SELECT R.A, SUM(S.C) AS D
      FROM R, S
      WHERE R.B=S.B
      GROUP BY R.A) AS T
HAVING COUNT(T.D) <= 2
GROUP BY T.A
```

Solution: a tuple (1,1)

b) Query 2.

```
SELECT DISTINCT R.A
FROM R
WHERE NOT EXISTS (SELECT *
                  FROM R R1, S
                  WHERE R1.B=S.B AND R.A > S.C)
```

Solution: values 1 and 3

c) Query 3.

$$\{x \mid \exists y\ R(x,y)\ \wedge\ \Big(\forall y\ \big(R(x,y) \rightarrow \exists u \exists v\ (S(u,y) \wedge S(v,y) \wedge u \neq v)\big)\Big)\}$$

Solution: a single value 3

Question 2. In this question, we use the following relational schema:

- `Country(name, capital, area)`, name is the key
- `People(country, population, children, adult)` where country refers to the name in `Country`, `population` is the total population, and `children` and `adult` is the percentage of the children and adult population.
- `Language(country,language,percentage)` – for each language spoken in the country, it lists the percentage of the population that speaks the language.

a) Write the following query in SQL: *Find names and capitals of countries where children outnumber adults, and at least three different languages are spoken.*

Solution:

```
SELECT C.name, C.capital
FROM Country C, People P, Language L
WHERE C.name=P.country AND C.name=L.country
      AND P.children > P.adult
GROUP BY C.name
HAVING COUNT(L.language) > 2
```

b) Write the following query in SQL: *Find languages that are only spoken in countries whose total population exceeds* 10^7.

Solution:

```
SELECT L.language
FROM Language L
WHERE NOT EXISTS (SELECT *
                  FROM Country C, People P, Language L1
                  WHERE C.name=P.country AND
                        C.name=L1.country AND
                        P.population < 10000000 AND
                        L.language = L1.language)
```

Question 4 Write the SQL query `SELECT MAX(A) FROM R` in relational algebra. You may assume that `R` has a single attribute `A`.

Solution: $R - \pi_A(\sigma_{A<B}(R \times \rho_{B \leftarrow A}(R)))$