W4. Relational algebra exercises

Part 1. RA Expressions

Perform following relational algebra operations on two relations R(A,B) and S(C,D). Represent the result as relation T.

R	
A	B
3	4
5	6

S	
C	D
4	7
1	6

1. $T = R \times S$

2. $T = \pi_A (R) \times S$

3. $T = \sigma_{A>C} (R \times S)$

Part 2. RA equivalencies

Given 2 relations R(A,B,C) and S(C, D, E) do the following equalities hold?

1. $\pi_A (R \times S) = \pi_A (R) \times S$

2. $\sigma_{A='c' \text{ AND } E=2} (R \times S) = \sigma_{A='c'} (R) \times \sigma_{E=2} (S)$

3. $\pi_A (\sigma_{B=2} (R)) = \sigma_{B=2} (\pi_A (R))$

Part 3. Output size

1. Given relation R with N tuples and relation S with M tuples, what is the maximum and minimum size of the output to the following queries:

σ_c (R)
- Min:
- Max:

π_A (R)
- Min:
- Max:

What if A is a key?
- Min:
- Max:

2. Given relation R (A,B) with N tuples and relation S(B,C) with M tuples, tell what is the maximum and minimum size of the output to the following queries

R x S
- Min:
- Max:

R ⋈ S
- Min:
- Max:

3. If I have a relation R with 100 tuples and a relation S with exactly 1 tuple, how many tuples will be in the result of **R left outer join S**?

   A. At least 100, but could be more

   B. Could be any number between 0 and 100 inclusive

   C. 0

   D. 1

   E. Exactly 100

Part 4. Complex RA queries

movie (title, year, length, incolor, studio, producer_cert)
star (name, address, gender, birthdate)
starsIn (movie_title, movie_year, star_name)
movieexec (name, address, cert, net_worth)
studio (name, president_cert)

Find all name pairs in form (movie star, movie producer) that live at the same address. The same person can be both a star and a producer. Now, try to eliminate palindrome pairs: leave (a,b) but not both (a,b) and (b,a). (for solutions see slides on RA queries)