

**Answers exercises Algebraic Query Optimization**  
**Thursday 12<sup>th</sup> September, 2024**

**Exercise 1**

Take two single attribute relations with tuples  $\langle 0 \rangle$  respectively  $\langle 1 \rangle$ .

**Exercise 2**

$\sigma_p(R - S) = \sigma_p(R) - \sigma_p(S) = \sigma_p(R) - S$ , for both sets and bags.

**Exercise 3**

Generally, it doesn't. Take the following two relations and project on A:

R	
A	B
1	2

S	
A	B
1	3

**Exercise 4**

$\sigma_p(R/S) = \sigma_p(R)/S$

Note that the left expression is only valid if  $attr(p) \subseteq (attr(R) - attr(S))$ .

**Exercise 5**

Suppose we have  $R(A, B)$  and  $S(A, B)$ .

$\Gamma_{A,F(B)}(R \cup S) = \Gamma_{A,F(B)}(\Gamma_{A,F(B)}(R) \cup \Gamma_{A,F(B)}(S))$ , for  $F$  is MIN, MAX or SUM.

$\Gamma_{A,CNT(B)}(R \cup S) = \Gamma_{A,SUM(C)}(\rho_{A,C}(\Gamma_{A,CNT(B)}(R)) \cup \rho_{A,C}(\Gamma_{A,CNT(B)}(S)))$ .

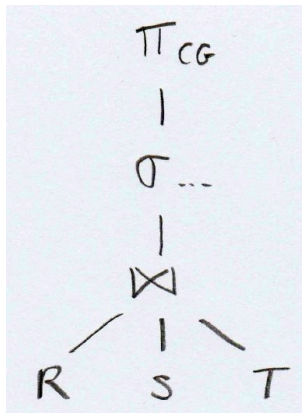
For  $F$  is AVG, things become more complex:

$Temp[A, Sum, Cnt] = \Gamma_{A,SUM(B),CNT(B)}(R) \cup \Gamma_{A,SUM(B),CNT(B)}(S)$ .

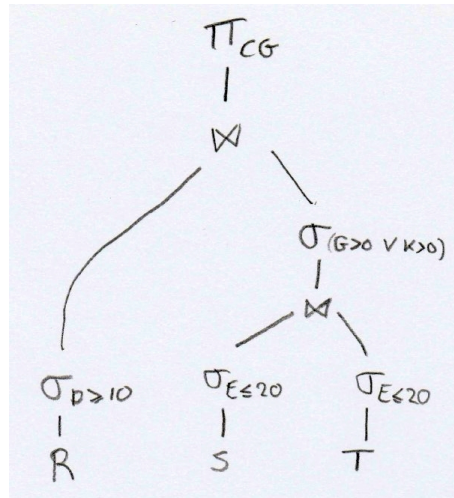
$\Gamma_{A,AVG(B)}(R \cup S) = \Gamma_{A,SUM(Sum)/SUM(Cnt)}(Temp)$

**Exercise 6**

Let us have a look at the parse tree of the original expression.



We push the selections as low as possible. We also choose a join order, based on the heuristic consideration that the selection on G and K reduces early.



Finally, we add projections.

