

Query languages

Assignment sheet 3

1 \subseteq for bags

\subseteq for bags can be defined by: $R \subseteq S$ if and only if for every x , the number of times x appears in R is less than or equal to the number of times it appears in S . Demonstrate or exhibit a counterexample to the following statements:

1. If $R \subseteq S$ and $S \subseteq R$ then $R = S$
2. If $R \subseteq S$, then $R \cup_B S = S$
3. If $R \subseteq S$, then $R \cap_B S = R$

2 Rewriting rules

Demonstrate or exhibit a counterexample to the following statements:

1. $\sigma_{p \vee q}(R \bowtie S) = (\sigma_p(R) \bowtie S) \cup_S (\sigma_q(S) \bowtie R)$, where p is a selection predicate over R and q is a selection predicate over S ,
2. $\sigma_{p \vee q}(R \bowtie S) = (\sigma_p(R) \bowtie S) \cup_B (\sigma_q(S) \bowtie R)$, where p is a selection predicate over R and q is a selection predicate over S ,
3. $\pi_X(R \cup_S S) = \pi_X(R) \cup_S \pi_X(S)$ where X is an attribute common to R and S
4. $\pi_X(R \setminus_S S) = \pi_X(R) \setminus_S \pi_X(S)$ where X is an attribute common to R and S
5. $R \cup_B R = R$
6. $R \cap_B R = R$
7. $R \setminus_B R = \emptyset$

3 δ operation

Consider the operator δ that removes duplicates. What are the rewriting rules that enable to push this operator down the query tree?

4 Subquery rewriting

In the case where a subquery is not correlated to the outer query, propose a rewriting of `SELECT x FROM R WHERE R.x > ANY (SELECT y FROM S)`.

5 Query containment

Consider the following queries:

$$\begin{aligned} q_0 & : \text{ans}(x, y) \leftarrow R(x, y) \\ q_1 & : \text{ans}(x, y) \leftarrow R(x, y_1), R(x_1, y_1), R(x_1, y) \\ q_2 & : \text{ans}(x, y) \leftarrow R(x, y_1), R(x_1, y_1), R(x_1, y_2), R(x_2, y_2), R(x_2, y) \\ q_3 & : \text{ans}(x, y) \leftarrow R(x, y_1), R(x_1, y) \end{aligned}$$

Show that $q_0 \subseteq q_1 \subseteq q_2 \subseteq q_3$