

Practice problem on semantic optimization

Let R be a relation over attributes ABC .

(i) Simplify the following query, knowing that it is applied only to relations R satisfying the fds $\{AC \rightarrow B, B \rightarrow C, C \rightarrow A\}$ (use tableau minimization and the chase):

$$q = \pi_{AB}[\pi_{AC}(R) \bowtie \pi_{CB}(R)] \bowtie \pi_{BC}[\pi_{BA}(R) \bowtie \pi_{AC}(R)].$$

(ii) Redo (i) for the query:

$$q = \pi_{AB}[\pi_{AC}(R) \bowtie \pi_{CB}(\sigma_{C=5}(R))] \bowtie \pi_{BC}[\pi_{BA}(R) \bowtie \pi_{AC}(\sigma_{A=8}(R))].$$

Solution (i) The tableau T corresponding to q is

A	B	C
a	b_1	c_1
a_1	b	c_1
a_2	b	c_2
a_2	b_2	c
a	b	c

Chasing with respect to $\Sigma = \{AC \rightarrow B, B \rightarrow C, C \rightarrow A\}$ yields:

$$CHASE_{\Sigma}(T) = \begin{array}{ccc} \hline A & B & C \\ a & b & c_1 \\ a & b & c_1 \\ a & b & c_1 \\ a & b_2 & c \\ \hline a & b & c \end{array}$$

Eliminating duplicate rows from $CHASE_{\Sigma}(T)$ yields the minimal tableau:

A	B	C
a	b	c_1
a	b_2	c
a	b	c

and the corresponding rspj query is

$$\pi_{AB}(R) \bowtie \pi_{AC}(R).$$

(ii) The tableau T corresponding to q is

A	B	C
a	b_1	5
a_1	b	5
8	b	c_2
8	b_2	c
a	b	c

Chasing with respect to $\Sigma = \{AC \rightarrow B, B \rightarrow C, C \rightarrow A\}$ yields (after eliminating duplicate rows):

$$CHASE_{\Sigma}(T) = \begin{array}{ccc} \hline A & B & C \\ 8 & b & 5 \\ 8 & b_2 & c \\ \hline 8 & b & c \end{array}$$

This tableau is minimal, and the corresponding rspj query is

$$\pi_{AB}(\sigma_{A=8}(\sigma_{C=5}(R))) \bowtie \pi_{AC}(\sigma_{A=8}(R)).$$