

CS277 – Relational Database Systems

Homework 3 (Due on Oct 27 2003)

Instructions: Answer all questions concisely.

1. Assume that **dom** is a set of n elements and r is an instance of a binary relation schema R over **dom** \times **dom**.
 - What is the largest possible size of r ?
 - What is the largest possible result of the following query?
 - $\text{Ans}(x,z) :- R(x,y), R(y,z).$
2. Prove that the SPCU algebra is monotonic. That is, prove that the composition of SPCU operators is monotonic. (Hint: prove by induction.)
3. Let Q_{\min} be a minimal conjunctive query. Show the following:
 - If Q is a conjunctive query and $Q \equiv Q_{\min}$, then every containment mapping h from Q to Q_{\min} is such that for every subgoal $S(x_1, \dots, x_k)$ of Q_{\min} , $S(h(y_1, \dots, y_j)) = S(x_1, \dots, x_k)$ for some subgoal $S(y_1, \dots, y_k)$ of Q .

(Hint: Prove by contradiction. Assume that there is a containment mapping $h: Q \rightarrow Q_{\min}$ such that for some subgoal $S(x_1, \dots, x_k)$ of Q_{\min} , none of the subgoals in Q maps to $S(x_1, \dots, x_k)$ under h . Show how this will contradict the minimality of Q_{\min}).