

Homework Assignment #3

CS 589/689 Principles of Database Systems: Fall 2008

This assignment is due Wednesday, 12 November, at the beginning of class. You are welcome to work this assignment alone or with a partner. If you work with a partner, please turn in just one paper with both of your names on it.

3A (10 points): Prove the correctness of the equivalence below, where A is an attribute in the schema of R .

$$\sigma_{A=a}(r \bowtie s) \equiv \sigma_{A=a}(r) \bowtie s$$

A set-theoretic definition of join is

$$r(R) \bowtie s(S) = \{t[RS] \mid t[R] \in r \text{ and } t[S] \in s\}.$$

3B (16 points): Give a counter-example for each of the following equivalences. (You should assume they are well formed.) The relations have schemas $r(R)$, $s(S)$ and $u(W)$ and X , Y and Z are sets of attributes.

a. $r \bowtie s \equiv r \bowtie \pi_X(s)$

b. $r \text{ LOJ } (s \text{ LOJ } u) \equiv (r \text{ LOJ } s) \text{ LOJ } u$

c. $G[X; C = \min(A)](r) \equiv \pi_{XC}(G[Y; C = \min(A)](r))$ (Assume A is in R)

d. $G1[M = \max(A)](\sigma_{A < 4}(r)) \equiv \sigma_{M < 4}(G1[M = \max(A)](r))$

3C (10 points): Give side conditions for the equivalences in 3B-a and 3B-c that will make the statement hold. Conditions should be at the schema level (rather than the relation-instance level). Try to make the conditions as permissive as possible.

3D (24 points): Which of the following equivalences hold? For those that don't, give a counter-example. Recall that \cup^+ (union-all) and π^+ (project-all) do not remove duplicates and that DE is the duplicate-elimination operator. Assume that join preserves duplicates.

a. $\pi_X^+(r \cup^+ s) \equiv \pi_X^+(r) \cup^+ \pi_X^+(s)$

b. $\pi_X(r \cup^+ s) \equiv \pi_X(r) \cup^+ \pi_X(s)$

c. $(r \cup^+ s) \bowtie u \equiv (r \bowtie s) \cup^+ (r \bowtie u)$

d. $\pi_X^+(\pi_Y(s)) \equiv \pi_X(\pi_Y^+(s))$

e. $\pi_X^+(\pi_X(s)) \equiv \pi_X(\pi_X^+(s))$

f. $DE(r \cup^+ s) \equiv DE(r) \cup^+ DE(s)$

3E (20 points) Minimize the following tableau query. (That is, find an equivalent tableau query with the fewest rows.) Show the substitution θ that maps the original tableau to the minimized tableau and, for each original row, say which row in the minimum tableau θ maps it to.

	<u>T(A</u>	<u>B</u>	<u>C</u>	<u>D</u>	<u>E)</u>
w1	a1	b	c1	d1	e1
w2	a2	b	c3	d2	e3
w3	5	b	c2	d1	e2
w4	a3	b1	c4	d1	3
w5	a4	b2	c	d3	e
w6	a5	b4	c	d5	e
w7	<u>a5</u>	<u>b3</u>	<u>c</u>	<u>d5</u>	<u>e4</u>
w		b	c		e