

CMPT 354 — Database Systems & Structures: Solution Assignment No. 1

Total scores: 60

Due: May 28

Spring 1998

Instructor: Osmar Zaiane

Question 1: Construct an ER diagram (12 points)

- 5 points for General understanding of problem and quality of diagram, legible work and design.
- 7 points for assumptions matching design decisions.

Presentation and clarity is taken into account.

Answer: Solutions differ.

Question 2 (24 points) Consider the following relational database:

person(*pname*, *street*, *city*)
works_for(*pname*, *cname*, *salary*)
company(*cname*, *city*)
manages(*pname*, *mname*)

Answer each of the queries in:

- the relational algebra
- the tuple relational calculus
- the domain relational calculus

1. Find the street and city of all employees who work for the SuperStore, live in Coquitlam, and earn more than 35,000. (2 marks each)

RA: $\Pi_{city, street}(\sigma_{city=Coquitlam \wedge cname=SuperStore \wedge salary > 35000}(person \bowtie works_for))$.

TRC:

$\{t | \exists p \in person (t[street] = p[street] \wedge t[city] = p[city] \wedge p[city] = Coquitlam) \wedge \exists w \in works_for (p[pname] = w[pname] \wedge w[pname] = SuperStore \wedge w[salary] > 35000)\}$

DRC: $\{ \langle s, c \rangle \mid \exists p (\langle p, s, c \rangle \in person \wedge c = Coquitlam \wedge \exists m, l (\langle p, m, l \rangle \in worksfor \wedge m = SuperStore \wedge s > 35000)) \}$

2. Find the names and the companies they work for, for all people who have a higher salary than their manager. (2 marks each)

RA: $\Pi_{wf.pname, wf.cname} (\sigma_{wm.mname=wf.pname \wedge wm.salary > wf.salary} (\rho_{wm} (worksfor \bowtie manages) \times \rho_{wf} worksfor))$.

TRC: $\{ t \mid \exists w \in worksfor (t[pname] = w[pname] \wedge t[cname] = w[cname]) \wedge \exists m \in manages (w[pname] = m[pname] \wedge \exists w2 \in worksfor (m[mname] = w2[pname] \wedge w[salary] > w2[salary])) \}$

DRC: $\{ \langle n, c \rangle \mid \exists p1, p2, c2, s1, s2 (\langle p1, c, s1 \rangle \in worksfor, \langle p2, c2, s2 \rangle \in worksfor \wedge \langle p1, p2 \rangle \in manages \wedge s1 > s2) \}$

3. Assume that companies may be located in several cities. Find all companies located in every city in which the SuperStore is located. (2 marks each)

RA: $company \div \pi_{city} (\sigma_{cname=SuperStore} (company))$

TRC: $\{ t \mid \forall c \in company (c[cname] = SuperStore \Rightarrow (\exists c2 \in company (t[cname] - ce[cname] \wedge c2[city] = c2[city]))) \}$

DRC: $\{ \langle c \rangle \mid \forall a, b ((\langle a, b \rangle \in company \wedge a = SuperStore) \Rightarrow \langle c, b \rangle \in company) \}$

Question 3: (12 points)(2 marks each) Let $R=(A,B,C)$ and $S=(D,E,F)$. Express each following expression in two other equivalent forms (relational algebra, tuple relational calculus, or domain relational calculus).

1. $\{ t \mid \exists u \in r, v \in s (u[C] = v[D] \wedge v[E] = "e" \wedge t[B] = u[B]) \}$, where $r(R)$ and $s(S)$.

$\pi_B(\sigma_{E="e" \wedge C=D}(r \times s)).where r(R) and s(S)$

$\{ \langle b \rangle \mid \exists a, c (\langle a, b, c \rangle \in r \wedge \exists x, y (\langle c, x, y \rangle \in s \wedge x = "e")) \} where r(R) and s(S)$

2. $\Pi_{A,B}(r_1) \bowtie \Pi_{B,C}(r_2)$, where $r_1(R)$ and $r_2(R)$.

$\{ t \mid \exists u \in r, u \in r (t[A] = u[A] \wedge t[B] = u[B] \wedge t[C] = v[C]) \wedge u[B] = v[B] \} where r(R)$

$\{ \langle a, b, c \rangle \mid \exists p, q (\langle a, b, p \rangle \in r_1 \wedge \langle q, b, c \rangle \in r_2) \} where r_1(R) and r_2(R)$

3. $\{ \langle a, b, d \rangle \mid \exists c (\langle a, b, c \rangle \in r \wedge \exists f (\langle a, d, f \rangle \in s)) \}$, where $r(R)$ and $s(S)$.

$\{ t \mid \exists u \in r (t[A] = u[A] \wedge t[B] = u[B] \wedge \exists v \in s (t[E] = v[E] \wedge u[A] = v[D])) \} where r(R) and s(S)$

$\pi_{A,B,E}(\sigma_{A=D}(r \times s)) where r(R) and s(S)$

Question 4: (12 points) (2 marks each)

Answer: Solutions differ.
