CS 541 SPRING 2012

ASSIGNMENT 2

SAMPLE SOLUTION

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TEXTBOOK EXERCISES

1. (Ex. 4.2)

$N_2 > N_1 > 0$

Part	Operation	Minimum possible size	Maximum possible size	Assumption about schemas of R_1 and R_2
(1)	$R_1 \cup R_2$	N_2	$N_1 + N_2$	union-compatible
(2)	$R_1 \cap R_2$	0	N_1	union-compatible
(4)	$R_1 \times R_2$	$N_1 \times N_2$	$N_1 \times N_2$	None
(5)	$\sigma_{a=5}(R_1)$	0	N_1	"a" is a field of R_1
(6)	$\pi_a(R_1)$	1	N_1	"a" is a field of R_1.

2. (Ex. 4.3)

Query 2:

- $\pi_{sid}\left(\sigma_{color = 'green' \vee color = 'red'} (Parts) \bowtie Catalog\right)$

- $\{ T \mid \exists C \in Catalog \; \exists P \in Parts$
  $((P.color = 'green' \vee P.color = 'red') \wedge$
  $C.pid = P.pid \wedge C.sid = T.sid)\}$

- $\{ \langle sid \rangle \mid \exists pid, cost$
  $(\langle sid, pid, cost \rangle \in Catalog \wedge \exists pname, color$
  $(\langle pid, pname, color \rangle \in Parts \wedge$
  $(color = "green" \vee color = "red"))) \}$

Query 4:

- $\pi_{sid}(\sigma_{color = 'red'} Parts \bowtie Catalog)$
  $\cap$
  $\pi_{sid}(\sigma_{color = 'green'} Parts \bowtie Catalog)$

- $\{ T \mid \exists C_1 \in Catalog \; \exists C_2 \in Catalog \; \exists P_1 \in Parts \; \exists P_2 \in Parts$
  $(C_1.sid = C_2.sid \wedge T.sid = C_1.sid \wedge$
  $C_1.pid = P_1.pid \wedge P_1.color = 'red' \wedge$
  $C_2.pid = P_2.pid \wedge P_2.color = 'green')\}$

- $\{ \langle sid \rangle \mid \exists pid1, pid2, cost1, cost2, pname1, pname2,$
  ~~$color1$~~, ~~$color2$~~
  $(\langle sid, pid1, cost1 \rangle \in Catalog \wedge \langle sid, pid2, cost2 \rangle \in$
  $Catalog$
  $\wedge \langle pid1, pname1, $~~$colo$~~$"red" \rangle \in Parts$
  $\wedge \langle pid2, pname2, "green" \rangle \in Parts)\}$

Query 9:

- ρ (pairs $(1 \to sid1,\ 2 \to pid1,\ 3 \to cost1,\ 4 \to sid2,\ 5 \to pid2,\ 6 \to cost2)$, catalog $\times$ catalog)

$\Pi_{sid1, sid2} (\sigma_{pid1 = pid2 \wedge cost1 > cost2} (pairs))$

- $\{ T \mid \exists C_1 \in Catalog\ \exists C_2 \in Catalog.$
  $(C_1.pid = C_2.pid \wedge C_1.cost > C_2.cost \wedge$
  $C_1.sid = T.sid1 \wedge C_2.sid = T.sid2) \}$

- $\{ \langle sid_1, sid_2 \rangle \mid \exists\ pid, cost1, cost2$
  $(\langle sid_1, pid, cost1 \rangle \in Catalog \wedge$
  $\langle sid2, pid, cost2 \rangle \in Catalog \wedge$
  $cost1 > cost2) \}$

Query 10:

- $\Pi_{pid1} (\sigma_{sid_1 \neq sid2 \wedge pid1 = pid2} (pairs))$

- $\{ T \mid \exists C_1 \in Catalog\ \exists C_2 \in Catalog.$
  $(C_1.pid = C_2.pid \wedge C_1.pid = T.pid \wedge$
  $C_1.sid \neq C_2.sid) \}.$

- $\{ \langle pid \rangle \mid \exists\ sid_1, sid2, cost1, cost2$
  $(\langle sid_1, pid, cost1 \rangle \in Catalog \wedge$
  $\langle sid2, pid, cost2 \rangle \in Catalog \wedge$
  $sid_1 \neq sid2) \}.$

Query 12:

- Find parts supplied by all Suppliers:

  $\rho(temp1, \pi_{pid}(Catalog / \pi_{sid}(Suppliers)))$

  Find parts that is charged for more than 200 by same supplier

  $\rho(temp2, \pi_{pid}(\sigma_{cost \geq 200}(Catalog)))$

  The answer is:

  $temp1 - temp2$

- ~~$\{T \mid \exists P \in Parts (\forall S \in Suppliers$~~
  ~~$(\exists C \in Catalog (C.pid = P.pid \wedge C.sid = S.sid)$~~
  ~~$\wedge \neg \exists C' \in Catalog (C'.pid =$~~

- $\{T \mid \exists P \in Parts$
  $(\forall S \in Suppliers (\exists C \in Catalog (C.pid = P.pid \wedge C.sid = S.sid))$
  $\wedge \neg (\exists S' \in Suppliers \exists C' \in Catalog (S'.sid = C'.sid \wedge P.pid = C'.pid \wedge C'.cost \geq 200))$
  $\wedge T.pid = P.pid)\}$

- $\{\langle pid \rangle \mid \exists pname, color$
  $(\langle pid, pname, color \rangle \in Parts \wedge$
  $(\forall \langle sid, sname, address \rangle \in Suppliers$
  $(\exists cost (\langle sid, pid, cost \rangle \in Catalog)))$
  $\wedge \neg (\exists \langle sid', sname', address' \rangle \in Suppliers$
  $(\exists cost (\langle sid, pid, cost \rangle \in Catalog \wedge cost \geq 200)))))$.

3. (Ex. 4.4. part 3)

Find names of suppliers who supplies some 'red' part with cost less than 100 and also supplies some 'green' part with cost less than 100.

RELATIONAL CALCULUS

Example of unsafe query:

a) ~~Find~~

$Q = \{ S \mid \exists C \in Catalog \ (C.sid < S.sid) \}$

This query is unsafe since the answer contains values that are not in $Dom(Q, I)$.

This query cannot be expressed by a relational algebra ~~expression~~ query since relational algebra binds all tuples to ~~relations~~ a relation, it is impossible to create an unsafe query in relational algebra.