EECS341 - Databases - HW#1

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Question #1

The division operator can be written as $\pi_a(R) - \pi_a((\pi_a(R) \times S) - R)$ where a is the attributes that are unique to R.

2.2

4.3

1. RA: $\pi_{sname}(\pi_{sid}((\pi_{pid}\sigma_{color='red'}Parts) \bowtie Catalog) \bowtie Suppliers)$
   TRC: $\{T | \exists T1 \in Suppliers(\exists X \in Parts(X.color =' red' \land \exists Y \in Catalog(Y.pid = X.pid \land Y.sid = T1.sid)) \land T.sname = T1.sname\}$

3. RA: $(\pi_{sid}((\pi_{pid}\sigma_{color='red'}Parts) \bowtie Catalog)) \cup (\pi_{sid}\sigma_{address='221PackerStreet'}Suppliers)$
   TRC: $\{T | \exists T1 \in Catalog(\exists X \in Parts(X.color =' red' \land X.pid = T1.pid) \land T.sid = T1.sid) \lor \exists T2 \in Suppliers(T2.Address =' 221packerStreet' \land T.sid = T2.sid)\}$

5. RA: $(\pi_{sid,pid}Catalog)/(\pi_{pid}Parts)$
   TRC: $\{t | \exists T1 \in Catalog(\forall X \in Parts(\exists T2 \in Catalog(T2.pid = X.pid \land T2.sid = T1.sid)) \land T.sid = T1.sid)\}$

7. RA: $(\pi_{sid,pid}Catalog)/(\pi_{pid}\sigma_{color='red' \lor color='green'}Parts)$
   TRC: $\{T | \exists T1 \in Catalog(\forall X \in Parts((X.color \neq' red' \land X.color \neq' green') \lor \exists T2 \in Catalog(T2.pid = X.pid \land T2.sid = T1.sid)) \land T.sid = T1.sid)\}$

9. RA: $\pi_{C1.sid,C2.sid}(\sigma_{C1.pid=C2.pid \wedge C1.sid \neq C2.sid \wedge C1.cost > C2.cost}(C1 \times C2))$
TRC: $\{T | \exists T1 \in Catalog(\exists T2 \in Catalog(T2.pid = T1.pid \wedge T2.sid \neq T1.sid \wedge T1.cose > T2.cost \wedge T.sida = T1.sid) \wedge T.sidb = T2.sid)\}$

11. RA: $((\pi_{sid}\sigma_{sname='YosemiteSham'}Suppliers) \bowtie Catalog) - (\pi_{sid,pid,cost}\sigma_{A.cost<B.cost}((\pi_{sid}\sigma_{sname='YosemiteSham'}S$ $Catalog) \times (\pi_{sid}\sigma_{sname='YosemiteSham'}Suppliers) \bowtie Catalog)))$
TRC: $\{T | \exists T1 \in Catalog(\exists X \in Suppliers(X.sname =' YosemiteSham' \wedge X.sid = T1.sid) \wedge \neg(\exists S \in Suppliers(S.sname =' YosemiteSham' \wedge \exists Z \in Catalog(Z.sid = S.sid \wedge Z.cost > T1.cost))) \wedge T.pid = T1.pid)\}$

4.4

1. Describes names of suppliers that sell red parts for less than 100.
2. There is an error in the syntax of the statement will return nothing because it projects *sid* then tries to project *sname* when it is not available.
3. Returns supplier names that sell red parts for under 100 and green parts for under 100.
4. Returns *sid*'s of suppliers that sell red parts for under 100 and green parts for under 100.
5. Returns the same as #3.

4.5

1. RA: $\pi_e id(\sigma_{aname='Boeing'}(Aircraft \bowtie Certified))$
TRC: $\{t | t \in Certified \wedge \exists A \in Aircraft(A.Aid = t.Aid \wedge A.aname =' Boeing')\}$

3. RA: $\rho(BonnToMadrid, \sigma_{from='Bonn' \wedge to='Madrid'}(Flights))\pi_a id(\sigma_{cruisingrange>distance}(Aircraft \times BonnToMadrid))$
TRC: $\{A.aid | A \in Aircraft \wedge \exists F \in Flights(F.from =' Bonn' \wedge F.to =' Madrid' \wedge A.cruisingrange > F.distance)\}$

5. RA: $\pi_{ename}(Employees \bowtie ((\pi_{eid}(\sigma_{cruisingrange>3000}(Aircraft \bowtie Certified)))\pi_{eid}(\sigma_{aname='Boeing'}(Aircraft \triangleright$ $Certified))))$
TRC: $\{E.ename | E \in Employees \wedge \exists C \in Certified(\exists A \in Aircraft(A.aid = C.aid \wedge E.eid = C.eid \wedge A.cruisingrange > 3000)) \wedge \neg(\exists C2 \in Certified(\exists A2 \in Aircraft(A2.aname =' Boeing' \wedge C2.aid = A2.aid \wedge C2.eid = E.eid)))\}$

7. RA: $\rho(E1, Employees)$
$\rho(E2, Employees)$
$\rho(E3, \pi_{E2.eid}(E1 \bowtie_{E1.salary>E2.salary} E2))\rho(E4, E2 \bowtie E3)$
$\rho(E5, E2 \bowtie E3)$
$\rho(E6, \pi_{E5.eid}(E4 \bowtie_{E1.salary>E5.salary} E5))$
$(\pi_{eid}E3) - E6$
TRC: $\{E1.eid | E1 \in Employees \wedge \exists E2 \in Employees(E2.salary > E1.salary \wedge \neg(\exists E3 \in Employees(E3.salary > E2.salary)))\}$

9. RA: $\rho(R1, Certified)$
$\rho(R2, Certified)$

$\rho(R3, Certified)$
$\rho(R4, Certified)$
$(\pi_{eid}(\sigma_{(R1.eid=R2.eid=r3.eid)\wedge(R1.aid\neq R2.aid\neq R3.aid)}(R1\times R2\times R3)))-(\pi_{eid}(\sigma_{(R1.eid=R2.eid=R3.eid=R4.eid)\wedge(R1.aid\neq R2}$
$R2 \times R3 \times R4)))$
TRC: $\{C1.eid | C1 \in Certified] wedge \exists C2 \in Certified(\exists C3 \in Certified(C1.eid = C2.eid \wedge C2.eid = C3.eid \wedge C1.aid \neq C2.aid \wedge C2.aid \neq C3.aid \wedge C3.aid \neq C1.aid \wedge \neg(\exists C4 \in Certified(C3.eid = C4.eid \wedge C1.aid \neq C4.aid \wedge C2.aid \neq C4.aid \wedge C3.aid \neq C4.aid))))\}$

11. Because there is no limit to the number of intermediate flights, a relational algebra or calculus equation can not be formed. If the number of intermediate flights was known, then a query could be written.

4.6

Relational completeness means that the language can express all queries expressed by relational algebra, but not necessarily every query.