CSCB20 - Assignment 1

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1 Relational Algebra

1.

Scheme		
Suppliers	Parts	Catalog
Sid sname address	pid pname colour	sid pid cost

(a) i. Finds all the names of suppliers who sell red products that cost less than \$100.

ii. Will be an empty column. Since the first operations (the σs and $\bowtie$s) isolate the red parts that cost less than \$100 and combines them. This is then joined with the supplier list. After this the column of the sid is isolated. Since sid is not the same as sname, the last projection will produce a blank relation.

iii. Finds the name of suppliers that sell both green and red items that cost less than \$100.

iv. Finds the i.d of suppliers that sell both green and red items that cost less than \$100.

v. Finds the name of suppliers that sell both green and red items that cost less than \$100.

(b)

i. $\Pi_{sname}(Suppliers \bowtie (Catalog \bowtie \sigma_{colour="red"}(Parts))$

ii. $\Pi_{sid}(Suppliers \bowtie (Catalog \bowtie \sigma_{colour="red" \vee "green"}(Parts))$

iii. $\Pi_{sid}(Suppliers \bowtie (Catalog \bowtie \sigma_{colour="red" \vee "green"}(Parts)) \vee \Pi_{sid}(\sigma_{address="1065 Military Trail"}(Suppliers)$

iv. $\Pi_{sid}(Suppliers \bowtie (Catalog \bowtie \sigma_{colour="red"}(Parts)) \wedge \Pi_{sid}(Suppliers \bowtie (Catalog \bowtie \sigma_{colour="green"}(Parts))$

v. $(\Pi_{sid,pid} Catalog)/(\Pi_{pid} Parts)$

vi. $(\Pi_{sid,pid} Catalog)/(\Pi_{pid} \sigma_{colour="red"} Parts)$

vii. $\Pi_{sid,pid}(Catalog)/\Pi_{pid}(\sigma_{colour="red" \vee "green"}(Parts)$

viii. $[(\Pi_{sid,pid} Catalog)/(\Pi_{pid} \sigma_{colour="green"} Parts)] \vee [(\Pi_{sid,pid} Catalog)/(\Pi_{pid} \sigma_{colour="green"} Parts)]$

ix. $\rho_{\alpha}(Catalog), \rho_{\beta}(Catalog)$
$\Pi_{\alpha.sid,\beta.sid}(\sigma_{\alpha.pid=\beta.pid \wedge \alpha.sid != \beta.sid \wedge \alpha.cost > \beta.cost}(\alpha \times \beta))$

x. $\rho_{\alpha}(Catalog), \rho_{\beta}(Catalog)$
$\Pi_{\alpha.pid}(\sigma_{\alpha.pid=\beta.pid \wedge \alpha.sid != \beta.sid}(\alpha \times \beta))$

xi. $R_1 := (\Pi_{sid}(\sigma_{sname="CanadaSuppliers"}(Suppliers))) \bowtie Catalog$
$\rho_{\alpha}(R_1)$
$R_2 := \Pi_{\alpha.sid,\alpha.pid,\alpha.cost}(\sigma_{\alpha.cost < R_1.cost}(\alpha \times R_1)$
$\Pi_{pid}(R_1 - \Pi_{sid,pid,cost}(R_2)$

xii. $\Pi_{pid,sid}(\sigma_{cost<200}(Catalog))/\Pi_{sid}(Suppliers)$

2. (a) i. $\Pi_{eid}(\sigma_{aname="Boeing"}(Aircraft \bowtie Certified))$

ii. $\Pi_{ename}(\sigma_{aname="Boeing"}(Aircraft \bowtie Certified \bowtie Employees))$

iii. $\Pi_{aid}(\sigma_{cruisingrange>distance}(Aircraft \times \sigma_{from="Bonn" \wedge to="Madrid"}(Flights)))$

iv. $\Pi_{flno}(\sigma_{cruisingrange>distance}((\sigma_{salary \geq 100000}(Employees) \bowtie Certified \bowtie Aircraft) \times Flights))$

v. $R_1 := \Pi_{eid}(\sigma_{cruisingrange>3000}(Aircraft \bowtie Certified)) - \Pi_{eid}(\sigma_{aname="Boeing"}(Aircraft \bowtie Certified))$
$\pi_{ename}(Employees \bowtie R_1)$

vi. $\rho_\alpha(Employees)$
$\Pi_{eid}(Employees) - \Pi_{eid}(\sigma_{Employees.salary<\alpha.salary}(Employees \times \alpha))$

vii. $\rho_\alpha(Employees)$
$\rho_{MAX}(\Pi_{eid}(Employees) - \Pi_{eid}(\sigma_{Employees.salary<\alpha.salary}(Employees \times \alpha)))$
$\rho_\beta(Employees - MAX)$
$\rho_\gamma(\beta)$
$\Pi_{eid}(\beta) - \Pi_{eid}(\sigma_{\beta.salary<\gamma.salary}(\beta \times \gamma))$

viii. We need to know the number of air crafts, and the number of air crafts is not an attribute in any of the relations, thus we need to count it. Counting can't be done with relational algebra. It can be done with SQL though.

ix. $\rho_\alpha(Certified)$
$\rho_\beta(Certified)$
$\rho_\gamma(Certified)$
$\rho_\theta(\alpha \times \beta \times \gamma)$
$\rho_\lambda(\theta \times Certified)$
$\sigma_{\alpha.eid=\beta.eid=\gamma.eid \wedge \alpha.aid \neq \beta.aid \neq \gamma.aid}(\theta) - \sigma_{\alpha.eid=\beta.eid=\gamma.eid=Certified.eid \wedge \alpha.aid \neq \beta.aid \neq \gamma.aid \neq Certified.aid}(\lambda)$

x. Since we need to add up values, it is not possible with relational algebra.