Tutorial 5.5 (Week 8)
Relational Algebra

Classroom Exercise

Question 1

(i)

Find the names of professors who work in departments that have fewer than 50 PhD students.

R1 := $\sigma_{NumPhds < 50}$ (DEPT)

Answer := π_{Pname} (PROF $\bowtie$ R1)

（ii）

Find the name(s) of student(s) with the lowest GPA.

R1 := $\gamma_{MIN(GPA) \rightarrow MinGPA}$ (STUDENT)

R2 := STUDENT $\bowtie_{STUDENT.GPA=R1.MinGPA}$ R1

Answer := π_{Sname} (R2)

(iii)

Find the names and majors of students who have taken the 'Database Systems' course.

R1 := $\pi_{Dname, Cno}$ ($\sigma_{Cname='Database\ Systems'}$ COURSE)

R2 := π_{Sid} (R1 $\bowtie$ ENROLL)

Answer := $\pi_{Sname, Dname}$ (R2 $\bowtie$ MAJOR $\bowtie$ STUDENT)

(iv)

Find the ids, names, and GPAs of the students who have taken all courses from the 'Civil Engineering' department.

R1 := pDname, Cno (sDname = 'Civil Engineering' COURSE)

R2 := pSid, Dname, Cno ENROLL

R3 := R2 ÷ R1

Answer := pSid, Sname, GPA (R3 $\bowtie$ STUDENT)

Question 2

(i)

$\pi_{\text{source\_city}} (\sigma_{\text{destination\_city = "Minneapolis"}} (\text{TRANS}))$
$\cap \pi_{\text{source\_city}} (\sigma_{\text{destination\_city = "San Francisco"}} (\text{TRANS}))$

(ii)

$\pi_{\text{train\_num,date}} (\text{DEPARTURES}) - \pi_{\text{train\_num,date}} (\text{RESERVATION})$

Question 3

(i)

$$(\pi_{teamid-one,teamid-two}(Results)) - ((\pi_{teamid-one,teamid-two}(\sigma_{scoreone>scoretwo}(Results))) \cup (\pi_{teamid-one,teamid-two}(\sigma_{scoreone<scoretwo}(Results))))$$

Answer: It lists the teamids for the matches that ended in a tie. However (a) if one match between ($team_1$, $team_2$) ended in a tie, (b) another match between them didn't, and (c) the order in which they were listed is the same (same team is listed as *teamid-one*), then that pair won't be listed.

(ii)

$$temp1 \leftarrow \rho_{r1(teamid)}(\pi_{teamid-one}(\sigma_{scoreone \geq scoretwo}(results))) \cup \rho_{r2(teamid)}(\pi_{teamid-two}(\sigma_{scoreone \leq scoretwo}(results)))$$

$$temp2 \leftarrow \pi_{teamid}(teams) - temp1$$

$$result \leftarrow \pi_{name}(teams \bowtie temp2)$$

*temp*1 contains all *teamid's* that have won or tied at least one game. *temp*2 is all teams that lost all games.

Question 4

Relation R(A) only has one attribute A.
We want to find max value in A.
S := R
R1 := $\sigma_{R.A < S.A}$ (R × S)
Answer := R – $\pi_{R.A}$ (R1)

Question 5

$$\pi_a(R) - \pi_{R.a}(\sigma_{(R_1.a > R.a) \wedge (R_2.a > R_1.a)}(R \times \rho_{R_1}(R) \times \rho_{R_2}(R)))$$