

CS 550 Database Systems

Assignment-2 | Part-A | Relational Algebra

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A)

$$T1 = \pi_{ssn}(\sigma_{dcode='CS' \wedge cno = '530'} Transcript)$$

$$Result = \pi_{ssn, name, major, status} (T1 \bowtie Student)$$

B)

$$T1 = \pi_{ssn}(\sigma_{dcode='CS' \wedge cno = '530'} Transcript)$$

$$Result = \pi_{ssn, name, major, status} (\sigma_{name = 'John'} (T1 \bowtie Student))$$

C)

Get students who have enrolled in a class and their respective prerequisites which they must satisfy:

$$T1 = \pi_{ssn, pcode, pno} ((Enrollment \bowtie Class) \bowtie Prereq)$$

Renaming pcode->dcode, pno->dno so as to check with transcripts:

$$AllPrereqs = \rho(pcode \rightarrow dcode, pno \rightarrow dno, T1)$$

Prereq courses for which transcripts are available (students have taken these prereq courses):

$$TransAvail = \pi_{ssn, dcode, cno} (AllPrereqs \bowtie Transcript)$$

Get ssn of students who do not have transcripts for prereq courses they must satisfy (i.e, they have not taken these prerequisite courses):

$$TempResult1 = \pi_{ssn} (AllPrereqs - TransAvail)$$

Now, Get SSN of students who have taken prerequisite courses but got a grade of 'C' or 'F':

$$TempResult2 = \pi_{ssn} (\sigma_{grade = 'C' \vee grade = 'F'} (AllPrereqs \bowtie Transcript))$$

Remove students who have not satisfied prerequisites from set of all students:

$$Result = ((\pi_{ssn} Student) - (TempResult1 \cup TempResult2)) \bowtie Student$$

D)

Get students who have enrolled in a class and their respective prerequisites which they must satisfy:

$$T1 = \pi_{ssn, pcode, pno} ((Enrollment \bowtie Class) \bowtie Prereq)$$

Renaming pcode->dcode, pno->dno so as to check with transcripts:

$$AllPrereqs = \rho(pcode \rightarrow dcode, pno \rightarrow dno, T1)$$

Prereq courses for which transcripts are available (students have taken these prereq courses):

$$TransAvail = \pi_{ssn, dcode, cno} (AllPrereqs \bowtie Transcript)$$

Get ssn of students who do not have transcripts for prereq courses they must satisfy (i.e, they have not taken these prerequisite courses):

$$TempResult1 = \pi_{ssn} (AllPrereqs - TransAvail)$$

Now, Get SSN of students who have taken prerequisite courses but got a grade of 'C' or 'F':

$$TempResult2 = \pi_{ssn} (\sigma_{grade = 'C' \vee grade = 'F'} (AllPrereqs \bowtie Transcript))$$

$$Result = (TempResult1 \cup TempResult2) \bowtie Student$$

E)

Get all the prerequisites that students named 'John' need to satisfy:

$$T1 = \pi_{ssn, pcode, pno} (((\sigma_{name='John'} Student \bowtie Enrollment) \bowtie Class) \bowtie Prereq)$$

Renaming pcode->dcode, pno->dno so as to check with transcripts:

$$AllPrereqs = \rho(pcode \rightarrow dcode, pno \rightarrow dno, T1)$$

Prereq courses for which transcripts are available (students have taken these prereq courses):

$$TransAvail = \pi_{ssn, dcode, cno} (AllPrereqs \bowtie Transcript)$$

Get ssn of students who do not have transcripts for prereq courses they must satisfy (i.e, they have not taken these prerequisite courses):

$$TempResult1 = \pi_{ssn} (AllPrereqs - TransAvail)$$

Now, Get SSN of students who have taken prerequisite courses but got a grade of 'C' or 'F':

$$TempResult2 = \pi_{ssn} (\sigma_{grade = 'C' \vee grade = 'F'} (AllPrereqs \bowtie Transcript))$$

$$Result = (TempResult1 \cup TempResult2) \bowtie Student$$

F)

Result = $\pi_{\text{dcode, cno}}(\text{course}) - \pi_{\text{dcode, cno}}(\text{prereq})$

G)

Result = $\pi_{\text{dcode, cno}}(\text{prereq})$

H)

Result = $\pi_{\text{class, dcode, cno, instr}} (\pi_{\text{dcode, cno}}(\text{prereq}) \bowtie \text{Class})$

I)

Result = Student - ($\pi_{\text{ssn}} (\sigma_{\text{grade} = 'C' \vee \text{grade} = 'F'} \text{Transcript}) \bowtie \text{Student}$)

J)

Get ssn of Professor named 'Brodsky' and rename the 'ssn' to 'instr':

R1 = $\rho(\text{ssn} \rightarrow \text{instr}, \pi_{\text{ssn}} (\sigma_{\text{name} = 'Brodsky'} \text{Faculty}))$

Get students who are enrolled in 'Brodsky' class:

Result = $\pi_{\text{ssn}} ((\text{R1} \bowtie \text{Class}) \bowtie \text{Enrollment}) \bowtie \text{Student}$

K)

Result = Enrollment / ($\pi_{\text{class}} \text{Class}$)

L)

Get all Math classes:

All_Math_Classes = $\pi_{\text{class}} (\sigma_{\text{dcode} = 'MTH'} \text{Class})$

Get all enrolled classes of students whose major is 'CS':

All_cs_enrol = $\pi_{\text{ssn, class}} ((\sigma_{\text{major} = 'CS'} \text{Student}) \bowtie \text{Enrollment})$

Divide All cs enrollments with all math classes:

Result = All_cs_enrol / All_Math_Classes