

Name: KEY

CS 589 Principles of Database Systems
Winter 2011
Quiz 3

No books or notes.

Consider the following Datalog program over stored facts in the following relations:

UnivReq(Course, Degree) Course is a university requirement for Degree
MajorReq(Course, Major) Course is a department requirement for Major
Prereq(PCourse, Course) PCourse is a prerequisite for Course

BAOnly(A) :- UnivReq(A, 'BA'), ¬MajorReq(A, 'Phil').
PhilOnly(B) :- MajorReq(B, 'Phil'), ¬UnivReq(B, 'BA').

Result(C1, C2) :- Prereq(C1, C2), BAOnly(C1), PhilOnly(C2).

3-A. (7 points) Give a relational-algebra query over UnivReq, MajorReq and Prereq that is equivalent to Result.

We can construct algebra expressions for BAOnly and PhilOnly using select, project and difference:

$$b = \pi_{\text{Course}}(\sigma_{\text{Degree}='BA'}(\text{UnivReq})) - \pi_{\text{Course}}(\sigma_{\text{Major}='Phil'}(\text{MajorReq}))$$

$$p = \pi_{\text{Course}}(\sigma_{\text{Major}='Phil'}(\text{MajorReq})) - \pi_{\text{Course}}(\sigma_{\text{Degree}='BA'}(\text{UnivReq}))$$

Now we need to rename the Course to PCourse in b so it will join with the correct attribute in Prereq:

$$r = \rho_{\text{Course-PCourse}}(b) \bowtie \text{Prereq} \bowtie p$$

Substituting in for b and p gives

$$r = \rho_{\text{Course-PCourse}}(\pi_{\text{Course}}(\sigma_{\text{Degree}='BA'}(\text{UnivReq})) - \pi_{\text{Course}}(\sigma_{\text{Major}='Phil'}(\text{MajorReq}))) \bowtie \text{Prereq} \bowtie (\pi_{\text{Course}}(\sigma_{\text{Major}='Phil'}(\text{MajorReq})) - \pi_{\text{Course}}(\sigma_{\text{Degree}='BA'}(\text{UnivReq})))$$

3-B. (3 points) Give a database instance such that the answer to your query is non-empty (and say what the answer is).

UnivReq('Lit101', 'BA').
MajorReq('Hist120', 'Phil').
Prereq('Lit101', 'Hist120').
gives the answer
Result('Lit101', 'Hist120').