Division in RA

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CS 3200

Northeastern University

Division Operation in RA A/B

- Given 2 relations A (courses) and B (students); A/B = let x, yA be two attributes in A and yB is an attribute in B with the same domain as the domain of yB
- A/B = {<x> such that for all <y> in B there exists <x ,y> an element of A = $\{< x > \mid \forall < y > \in B \; \exists < x, y > \in A\}$
- A/B contains all x tuples (courses) such that for every y tuple value (students) in B, there is an xy tuple in A.
- • Or: If the set of y values (courses) associated with an x value (students) in A contains all y values in B, the x value is in A/B.
  - In general, x and y can be any lists of attributes
  - y is the list of fields in B, and x U y is the list of fields of A.
- Assume x = course id and y = student id - What is the query asking for?

The MEGA-STUDENT(s) someone who has taken all courses that are in the course table

Example of division

Table A

Student Id (x)	Course Id (y)
10	cs200
10	cs100
10	cs300
10	cs400
20	cs300
30	cs200
15	cs400
15	cs100
25	cs100
25	cs200

Instances of B

Course Id
cs200

Course Id
cs200
cs100

Course Id
cs100
cs200
cs300

Corresponding Instances of A/B

Student Id
10
30
25

Student Id
10
25

Student Id
10

Basic operations for Division

- Compute all x values in A that are not disqualified
  - How is a value disqualified?
  - If by attaching a y value from B, we obtain a tuple NOT in A
  - $\pi_x((\pi_x(A) \text{x } B) - A)$

- $\pi_x(A) - \pi_x((\pi_x(A) \text{x } B) - A)$

Step by step process of Division

B

Course Id
cs200

A

Student Id (x)	Course Id (Cid y)
10	cs200
10	cs100
10	cs300
10	cs400
20	cs300
30	cs200
15	cs400
15	cs100
25	cs100
25	cs200

$(\pi_x(A) \text{x } B)$

Student Id, CId
10, cs200
20, cs200
30, cs200
15,cs200
25, cs200

$(\pi_x(A) \text{x } B)$ - A

Student Id,Cid
20, cs200
15,cs200

$\pi_x((\pi_x(A) \text{x } B) - A)$

$\pi_x(A) - \pi_x((\pi_x(A) \text{x } B) - A)$

Student Id
10
30
25

Student Id
20
15

Schema for examples

S1

SID	Name	Login	DoB	GPA
55515	Smith	smith@ccs	Jan 10,1990	3.82
55516	Jones	jones@hist	Feb 11, 1992	2.98
55517	Ali	ali@math	Sep 22, 1989	3.11
55518	Smith	smith@math	Nov 30, 1991	3.32

S2

SID	Name	Login	DoB	GPA
55575	Chen	chen@ccs	Jan 10,1990	3.01
55579	Alton	alton@hist	Jun 11, 1992	2.07
55517	Ali	ali@math	Sep 22, 1989	3.11
55518	Smith	smith@math	Nov 30, 1991	3.32

registration

Sid	CId	LID	Grade
55515	History 101	45	C
55516	History 101	47	A
55517	History 101	45	B
55518	Music 101	48	A

Lecturers

LID	Name	CID
45	Fisk	History 101
46	Alder	Biology 220
47	Wong	History 101
48	Foster	Music 101