More Slides on "Division Operation" in Relational Algebra Query Language

(& together with examples on Assignment operation)

Assignment Operation

- The assignment operation (←) provides a convenient way to express **complex queries**.
  - **Write query as a sequential program** consisting of
    - a series of assignments
    - followed by an expression whose value is displayed as a result of the query.
  - Assignment **must always** be made to a temporary relation variable.
    - *Example of assignment comes late with the Division statement*

Division Operation

- Suited to queries that include the phrase **"for all"**.
- Let *r* and *s* be relations on schemas *R* and *S* respectively

$$r \div s$$

  - $R = (A_1, \ldots, A_m, B_1, \ldots, B_n)$
  - $S = (B_1, \ldots, B_n)$

The result of r ÷ s is a relation on schema

$R - S = (A_1, \ldots, A_m)$

$$r \div s = \{ t \mid t \in \prod_{R-S}(r) \wedge \forall\, u \in s\, (tu \in r) \}$$

* ***u*** *representing any tuple in s*

Where *tu* means the concatenation of a tuple *t* and *u* to produce a single tuple

* *for every tuple in R-S (called t), there are a set of tuples in R, such that for all tuples (such as u) in s, the tu is a tuple in R.*

Division Operation – Example

- Relations *r, s*:

A	B
α	1
α	2
α	3
β	1
γ	1
δ	1
δ	3
δ	4
ϵ	6
ϵ	1
β	2

r

B
1
2

s

- $r \div s$:

A
α
β

e.g.

A is customer name

B is branch-name

1and 2 here show two specific branch-names

(Find customers who have an account in all branches of the bank)

Another Division Example

- Relations *r, s*:

A	*B*	*C*	*D*	*E*
α	a	α	a	*1*
α	a	γ	a	*1*
α	a	γ	b	*1*
β	a	γ	a	*1*
β	a	γ	b	*3*
γ	a	γ	a	*1*
γ	a	γ	b	*1*
γ	a	β	b	*1*

r

D	*E*
a	*1*
b	*1*

s

- *r* ÷ *s*:

A	*B*	*C*
α	a	γ
γ	a	γ

e.g.
Students who have taken both "a" and "b" courses, with instructor "1"

(Find students who have taken all courses given by instructor 1)

Assignment Operation

- Example of writing division with set difference, projection, and assignments: $r \div s$

$$temp1 \leftarrow \prod_{R-S} (r)$$

$$temp2 \leftarrow \prod_{R-S} ((temp1 \times s) - \prod_{R-S,S} (r))$$

$$result = temp1 - temp2$$

– The result to the right of the $\leftarrow$ is assigned to relation variable on the left of the $\leftarrow$.

– May use variables in subsequent expressions

** Try executing the above query at home on the previous example, to convince yourself about its equivalence to the division operation*