UNIVERSITY OF ENGINEERING & MANAGEMENT, KOLKATA

Course Name : Database Management System

Dr. Sandip Mandal
Dept. of CSE, UEM Kolkata
WhatsApp : +91-8449007365
Email : sandip.mandal@uem.edu.in

Module 3: Union and Rename

instructor.ID	name	dept_name	salary
10101	Srinivasan	Comp. Sci.	65000
10101	Srinivasan	Comp. Sci.	65000
10101	Srinivasan	Comp. Sci.	65000
12121	Wu	Finance	90000
15151	Mozart	Music	40000
22222	Einstein	Physics	95000
32343	El Said	History	60000
45565	Katz	Comp. Sci.	75000
45565	Katz	Comp. Sci.	75000
76766	Crick	Biology	72000
76766	Crick	Biology	72000
83821	Brandt	Comp. Sci.	92000
83821	Brandt	Comp. Sci.	92000
83821	Brandt	Comp. Sci.	92000
98345	Kim	Elec. Eng.	80000

Instructor_ID	course_id	sec_id	semester	year
10101	CS-101	1	Fall	2017
10101	CS-315	1	Spring	2018
10101	CS-347	1	Fall	2017
12121	FIN-201	1	Spring	2018
15151	MU-199	1	Spring	2018
22222	PHY-101	1	Fall	2017
32343	HIS-351	1	Spring	2018
45565	CS-101	1	Spring	2018
45565	CS-319	1	Spring	2018
76766	BIO-101	1	Summer	2017
76766	BIO-301	1	Summer	2018
83821	CS-190	1	Spring	2017
83821	CS-190	2	Spring	2017
83821	CS-319	2	Spring	2018
98345	EE-181	1	Spring	2017

Union Operation

- The union operation allows us to combine two relations
- Notation: $r \cup s$
- For $r \cup s$ to be valid.

  1. *r, s* must have the *same* **arity** (same number of attributes)
  2. The attribute domains must be **compatible** (example: 2nd column of *r* deals with the same type of values as does the 2nd column of *s*)

- Example: to find all courses taught in the Fall 2017 semester, or in the Spring 2018 semester, or in both

$$\Pi_{course\_id}(\sigma_{semester=\text{“Fall”} \wedge year=2017}(section)) \cup$$

$$\Pi_{course\_id}(\sigma_{semester=\text{“Spring”} \wedge year=2018}(section))$$

Union Operation (Cont.)

- Result of:

$$\Pi_{course\_id}\,(\sigma_{semester=\text{“Fall”} \wedge year=2017}\,(section)) \cup \Pi_{course\_id}\,(\sigma_{semester=\text{“Spring”} \wedge year=2018}\,(section))$$

course_id
CS-101
CS-315
CS-319
CS-347
FIN-201
HIS-351
MU-199
PHY-101

Set-Intersection Operation

- The set-intersection operation allows us to find tuples that are in both the input relations.
- Notation: $r \cap s$
- Assume:
  - r, s have the *same arity*
  - attributes of r and s are compatible
- Example: Find the set of all courses taught in both the Fall 2017 and the Spring 2018 semesters.

$$\Pi_{course\_id}(\sigma_{semester=\text{“Fall”} \wedge year=2017}(section)) \cap \Pi_{course\_id}(\sigma_{semester=\text{“Spring”} \wedge year=2018}(section))$$

  - Result

course_id
CS-101

Set Difference Operation

- The set-difference operation allows us to find tuples that are in one relation but are not in another.
- Notation $r - s$
- Set differences must be taken between **compatible** relations.
  - r and s must have the same arity
  - attribute domains of r and s must be compatible
- Example: to find all courses taught in the Fall 2017 semester, but not in the Spring 2018 semester

$$\Pi_{course\_id}(\sigma_{semester=\text{“Fall”} \wedge year=2017}(section)) - \Pi_{course\_id}(\sigma_{semester=\text{“Spring”} \wedge year=2018}(section))$$

course_id
CS-347
PHY-101

The Assignment Operation

- It is convenient at times to write a relational-algebra expression by assigning parts of it to temporary relation variables.
- The assignment operation is denoted by ← and works like assignment in a programming language.
- Example: Find all instructor in the "Physics" and Music department.

$$Physics \leftarrow \sigma_{dept\_name="Physics"}(instructor)$$
$$Music \leftarrow \sigma_{dept\_name="Music"}(instructor)$$
$$Physics \cup Music$$

- With the assignment operation, a query can be written as a sequential program consisting of a series of assignments followed by an expression whose value is displayed as the result of the query.

The Rename Operation

- The results of relational-algebra expressions do not have a name that we can use to refer to them. The rename operator, ρ, is provided for that purpose
- The expression:

$$\rho_x(E)$$

returns the result of expression *E* under the name *x*

- Another form of the rename operation:

$$\rho_{x(A1,A2,..An)}(E)$$

Equivalent Queries

- There is more than one way to write a query in relational algebra.
- Example: Find information about courses taught by instructors in the Physics department with salary greater than 90,000
- Query 1

$$\sigma_{dept\_name=\text{“Physics”} \wedge salary > 90{,}000}(instructor)$$

- Query 2

$$\sigma_{dept\_name=\text{“Physics”}}(\sigma_{salary > 90.000}(instructor))$$

- The two queries are not identical; they are, however, equivalent -- they give the same result on any database.

Equivalent Queries

- There is more than one way to write a query in relational algebra.
- Example: Find information about courses taught by instructors in the Physics department
- Query 1

$$\sigma_{dept\_name = \text{“Physics”}}(instructor \bowtie_{instructor.ID = teaches.ID} teaches)$$

- Query 2

$$(\sigma_{dept\_name = \text{“Physics”}}(instructor)) \bowtie_{instructor.ID = teaches.ID} teaches$$

- The two queries are not identical; they are, however, equivalent -- they give the same result on any database.

Thank You