Joining data

- Consider joining course and pre-req tables on course_id
  - A ‘natural’ join
  - Gives all courses ‘c’ with its pre-req ‘p’
- What happens if a course has no pre-req ? Or a pre-req has no course (for some reason) ?
- Query is : get all courses and their pre-req if any !
- Requires us to keep data from non-matched tuples also !

Join operations – Example

- Relation *course*

course_id	*title*	*dept_name*	*credits*
BIO-301	Genetics	Biology	4
CS-190	Game Design	Comp. Sci.	4
CS-315	Robotics	Comp. Sci.	3

- **Relation *prereq***

course_id	*prereq_id*
BIO-301	BIO-101
CS-190	CS-101
CS-347	CS-101

- **Observe that**

  prereq information is missing for CS-315 and

  course information is missing for CS-437

Outer Join

- An extension of the join operation that avoids loss of information
- Computes the join and then adds tuples form one relation that does not match tuples in the other relation to the result of the join
  - Uses *null* values.

Left Outer Join

- ***course* natural left outer join *prereq***

course_id	*title*	*dept_name*	*credits*
BIO-301	Genetics	Biology	4
CS-190	Game Design	Comp. Sci.	4
CS-315	Robotics	Comp. Sci.	3

course_id	*prereq_id*
BIO-301	BIO-101
CS-190	CS-101
CS-347	CS-101

course_id	*title*	*dept_name*	*credits*	*prere_id*
BIO-301	Genetics	Biology	4	BIO-101
CS-190	Game Design	Comp. Sci.	4	CS-101
CS-315	Robotics	Comp. Sci.	3	*null*

Right Outer Join

- ***course* natural right outer join *prereq***

course_id	*title*	*dept_name*	*credits*
BIO-301	Genetics	Biology	4
CS-190	Game Design	Comp. Sci.	4
CS-315	Robotics	Comp. Sci.	3

course_id	*prereq_id*
BIO-301	BIO-101
CS-190	CS-101
CS-347	CS-101

course_id	*title*	*dept_name*	*credits*	*prere_id*
BIO-301	Genetics	Biology	4	BIO-101
CS-190	Game Design	Comp. Sci.	4	CS-101
CS-347	*null*	*null*	*null*	CS-101

Joined Relations

- Specify:
  - Join condition – how tuples are to be matched
  - Join type – how non-matching tuples are to be treated are treated

Join types
inner join
left outer join
right outer join
full outer join

Join Conditions
natural
on <predicate>
using $(A_1, A_1, \ldots, A_n)$

Full Outer Join

- ***course* natural full outer join *prereq***

course_id	*title*	*dept_name*	*credits*	*prereq_id*
BIO-301	Genetics	Biology	4	BIO-101
CS-190	Game Design	Comp. Sci.	4	CS-101
CS-315	Robotics	Comp. Sci.	3	*null*
CS-347	*null*	*null*	*null*	CS-101

Unmatched tuples from both are included

Joined Relations – Examples

- *course* inner join *prereq* on
  course.course_id = prereq.course_id

course_id	*title*	*dept_name*	*credits*	*prereq_id*	*course_id*
BIO-301	Genetics	Biology	4	BIO-101	BIO-301
CS-190	Game Design	Comp. Sci.	4	CS-101	CS-190

- **What is the difference between the above, and a natural join?**
- *course* **left outer join** *prereq* **on**
  course.course_id = prereq.course_id

course_id	*title*	*dept_name*	*credits*	*prereq_id*	*course_id*
BIO-301	Genetics	Biology	4	BIO-101	BIO-301
CS-190	Game Design	Comp. Sci.	4	CS-101	CS-190
CS-315	Robotics	Comp. Sci.	3	*null*	*null*

Joined Relations – Examples

- *course* **natural right outer join** *prereq*

course_id	*title*	*dept_name*	*credits*	*prereq_id*
BIO-301	Genetics	Biology	4	BIO-101
CS-190	Game Design	Comp. Sci.	4	CS-101
CS-347	*null*	*null*	*null*	CS-101

- *course* **full outer join** *prereq* **using** (*course_id*)

course_id	*title*	*dept_name*	*credits*	*prereq_id*
BIO-301	Genetics	Biology	4	BIO-101
CS-190	Game Design	Comp. Sci.	4	CS-101
CS-315	Robotics	Comp. Sci.	3	*null*
CS-347	*null*	*null*	*null*	CS-101

Views

- all users do not need to see all DB contents
  - E.g., a person who needs to know an instructors name and department, but not the salary.
  - This person should see a relation defined in SQL by

    select *ID*, *name*, *dept_name*
    from *instructor*

- A view provides a mechanism to hide certain data from the view of certain users.
  - a “virtual relation” (not actually stored)

View Definition

- Defining a view v :

  create view *v* as < query expression >

- Once defined, the view name can be used to refer to the virtual relation as if it exists !
- View is not evaluated
  - view definition is stored as an expression; the expression is substituted into queries which use the view.

Example Views

- A view of instructors without their salary

  create view *faculty* as

  select *ID*, *name*, *dept_name*

  from *instructor*

Has these 3 columns

- Using the view : Find all instructors in the Biology department

  select *name*

  from *faculty*

  where *dept_name* = 'Biology'

- Create a view of department salary totals

create view *depts_with_salary* (*dept_name*, *total_salary*)
as
select *dept_name*, sum (*salary*)
from *instructor*
group by *dept_name*;