Joins

Database Systems (CSCI 440)

Fall 2014

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Administrivia

Homework #1:

due Friday, September 26, 2014

Midterm #1:

in-class Friday, October 3, 2014

Project Proposal:

by 5pm: Monday, October 8, 2014

Reading:

Chapter 5.1.6
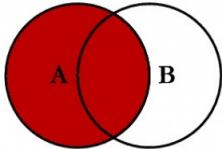
Joins

> **Definition**
>
> A **joined table** permits users to specify a table resulting from a join operation in the FROM clause of a query.

- Inner Join
- Outer Join
    - Left Outer Join
    - Right Outer Join
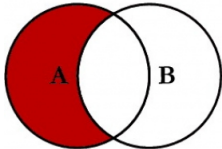   - Full Outer Join
- Cross Join
- Natural Join

Q1A: **SELECT**   Fname, Lname, Address
           FROM   (EMPLOYEE **JOIN** DEPARTMENT **ON** Dno=Dnumber)
           WHERE   Dname='Research';

SQL JOINS

SELECT <select_list>
FROM TableA A
LEFT JOIN TableB B
ON A.Key = B.Key

SELECT <select_list>
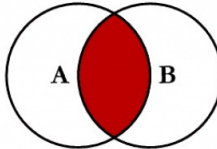FROM TableA A
RIGHT JOIN TableB B
ON A.Key = B.Key

SELECT <select_list>
FROM TableA A
INNER JOIN TableB B
ON A.Key = B.Key

SELECT <select_list>
FROM TableA A
LEFT JOIN TableB B
ON A.Key = B.Key
WHERE B.Key IS NULL

SELECT <select_list>
FROM TableA A
RIGHT JOIN TableB B
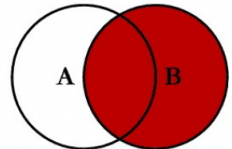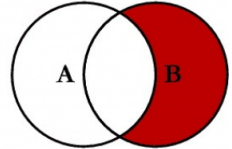ON A.Key = B.Key
WHERE A.Key IS NULL

SELECT <select_list>
FROM TableA A
FULL OUTER JOIN TableB B
ON A.Key = B.Key
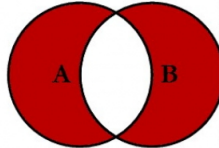
SELECT <select_list>
FROM TableA A
FULL OUTER JOIN TableB B
ON A.Key = B.Key
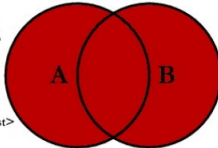WHERE A.Key IS NULL
OR B.Key IS NULL

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Definition

Inner Join returns tuples in the result only if a matching tuple exists in the other relation.

This is the default type of join in a joined table.
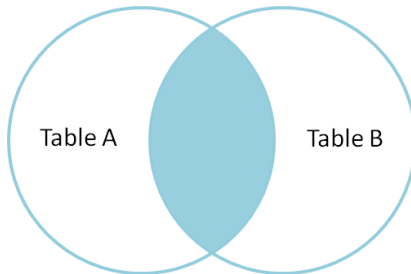
Rank	Name
Corporal	Punishment
Major	Payne
General	Store

Rank	Name
Private	Payne
Captain	Crunch
Major	Minor

```
SELECT * FROM T1
INNER JOIN T2
ON T1.rank = T2.rank;
```

Inner Join Example 1

Rank	Name
Corporal	Punishment
Major	Payne
General	Store

Rank	Name
Private	Payne
Captain	Crunch
Major	Minor

```sql
SELECT * FROM T1
INNER JOIN T2
ON T1.rank = T2.rank;
```

Rank	Name	Rank	Name
Major	Payne	Major	Minor

Inner Join Example 2

Rank	Name
Corporal	Punishment
Major	Payne
General	Store

Rank	Name
Private	Payne
Captain	Crunch
Major	Minor

```sql
SELECT * FROM T1
INNER JOIN T2
ON T1.name= T2.name;
```

Inner Join Example 2

Rank	Name
Corporal	Punishment
Major	Payne
General	Store

Rank	Name
Private	Payne
Captain	Crunch
Major	Minor

```sql
SELECT * FROM T1
INNER JOIN T2
ON T1.name= T2.name;
```

Rank	Name	Rank	Name
Major	Payne	Private	Payne

Left Outer Join

Definition

Left Outer Join returns every tuple in left table in result even if no matching tuple in the right.

NULL values are given for missing attributes of right table.
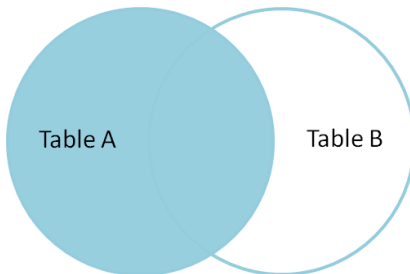
Left Outer Join Example 1

Rank	Name
Corporal	Punishment
Major	Payne
General	Store

Rank	Name
Private	Payne
Captain	Crunch
Major	Minor

```sql
SELECT * FROM T1
LEFT OUTER JOIN T2
ON T1.rank= T2.rank;
```

Left Outer Join Example 1

Rank	Name
Corporal	Punishment
Major	Payne
General	Store

Rank	Name
Private	Payne
Captain	Crunch
Major	Minor

```
SELECT * FROM T1
LEFT OUTER JOIN T2
ON T1.rank= T2.rank;
```

Rank	Name	Rank	Name
Major	Payne	Major	Minor
Corporal	Punishment	NULL	NULL
General	Store	NULL	NULL

Rank	Name
Corporal	Punishment
Major	Payne
General	Store

Rank	Name
Private	Payne
Captain	Crunch
Major	Minor

```
SELECT * FROM T1
LEFT OUTER JOIN T2
ON T1.name= T2.name;
```

Left Outer Join Example 2

Rank	Name
Corporal	Punishment
Major	Payne
General	Store

Rank	Name
Private	Payne
Captain	Crunch
Major	Minor

```sql
SELECT * FROM T1
LEFT OUTER JOIN T2
ON T1.name= T2.name;
```

Rank	Name	Rank	Name
Major	Payne	Private	Payne
Corporal	Punishment	NULL	NULL
General	Store	NULL	NULL

Set Difference with Left Outer Join

Definition

Left Outer Join can find the set difference if you exclude the unwanted records from the right side using a where clause.

Rank	Name
Corporal	Punishment
Major	Payne
General	Store

Rank	Name
Private	Payne
Captain	Crunch
Major	Minor

```
SELECT * FROM T1
LEFT OUTER JOIN T2
ON T1.name = T2.name
WHERE T2.rank IS NULL;
```
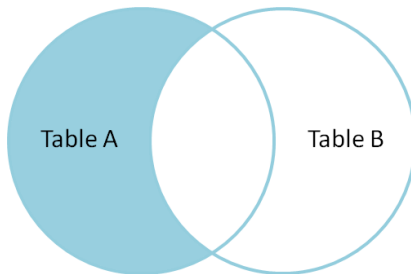
Left Outer Join (Set Difference) Example

Rank	Name
Corporal	Punishment
Major	Payne
General	Store

Rank	Name
Private	Payne
Captain	Crunch
Major	Minor

```sql
SELECT * FROM T1
LEFT OUTER JOIN T2
ON T1.name = T2.name
WHERE T2.rank IS NULL;
```

Rank	Name	Rank	Name
Corporal	Punishment	NULL	NULL
General	Store	NULL	NULL

Full Outer Join

Definition

Full Outer Join produces the set of all records in both tables, with matching records from both sides where available. When there is no match, the missing side will contain `NULL`.

Table A   Table B

Rank	Name
Corporal	Punishment
Major	Payne
General	Store

Rank	Name
Private	Payne
Captain	Crunch
Major	Minor

```
SELECT * FROM T1
FULL OUTER JOIN T2
ON T1.name= T2.name;
```
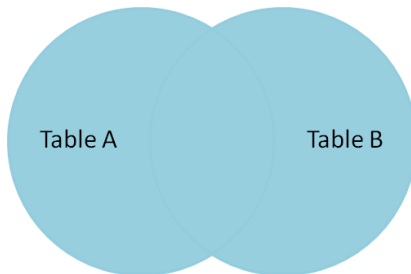
Full Outer Join

Rank	Name
Corporal	Punishment
Major	Payne
General	Store

Rank	Name
Private	Payne
Captain	Crunch
Major	Minor

```
SELECT * FROM T1
FULL OUTER JOIN T2
ON T1.name= T2.name;

SELECT * FROM T1
LEFT OUTER JOIN T2
ON T1.name = T2.name
UNION
SELECT * FROM T1
RIGHT OUTER JOIN T2
ON T1.name = T2.name;
```

Full Outer Join Example

Rank	Name
Corporal	Punishment
Major	Payne
General	Store

Rank	Name
Private	Payne
Captain	Crunch
Major	Minor

Full Outer Join Example

Rank	Name
Corporal	Punishment
Major	Payne
General	Store

Rank	Name
Private	Payne
Captain	Crunch
Major	Minor

Rank	Name	Rank	Name
Major	Payne	Private	Payne
Corporal	Punishment	NULL	NULL
General	Store	NULL	NULL
NULL	NULL	Captain	Crunch
NULL	NULL	Major	Minor

Definition

Full Outer Join can find the symmetric set difference if you exclude the unwanted records from both sides using a where clause.

Rank	Name
Corporal	Punishment
Major	Payne
General	Store

Rank	Name
Private	Payne
Captain	Crunch
Major	Minor

```
SELECT * FROM T1 FULL OUTER JOIN T2
ON T1.name= T2.name
WHERE T1.rank IS NULL WHERE T2.rank IS NULL;
```

Rank	Name
Corporal	Punishment
Major	Payne
General	Store

Rank	Name
Private	Payne
Captain	Crunch
Major	Minor

```sql
SELECT * FROM T1 FULL OUTER JOIN T2
ON T1.name= T2.name
WHERE T1.rank IS NULL WHERE T2.rank IS NULL;

SELECT * FROM T1 LEFT OUTER JOIN T2
ON T1.name = T2.name WHERE T2.rank is NULL
UNION
SELECT * FROM T1 RIGHT OUTER JOIN T2
ON T1.name = T2.name WHERE T1.rank is NULL;
```

Symmetric Difference with Full Outer Join Example

Rank	Name
Corporal	Punishment
Major	Payne
General	Store

Rank	Name
Private	Payne
Captain	Crunch
Major	Minor

Rank	Name
Corporal	Punishment
Major	Payne
General	Store

Rank	Name
Private	Payne
Captain	Crunch
Major	Minor

Rank	Name	Rank	Name
Corporal	Punishment	NULL	NULL
General	Store	NULL	NULL
NULL	NULL	Captain	Crunch
NULL	NULL	Major	Minor

Cross Join

Definition

Cross Join returns the Cartesian product of rows from tables in the join. In other words, it will produce rows which combine each row from the first table with each row from the second table.

```
SELECT * FROM T1 CROSS JOIN T2;
```

This joins 'everything to everything', resulting in $n \times m$ rows.

Rank	Name
Corporal	Punishment
Major	Payne
General	Store

Rank	Name
Private	Payne
Captain	Crunch
Major	Minor

Rank	Name
Corporal	Punishment
Major	Payne
General	Store

Rank	Name
Private	Payne
Captain	Crunch
Major	Minor

Rank	Name	Rank	Name
Corporal	Punishment	Private	Payne
Major	Payne	Private	Payne
General	Store	Private	Payne
Corporal	Punishment	Captain	Crunch
Major	Payne	Captain	Crunch
General	Store	Captain	Crunch
Corporal	Punishment	Major	Minor
Major	Payne	Major	Minor
General	Store	Major	Minor

Natural Join

Definition

Natural Join does not specify a join condition and imposes an implicit EQUIJOIN condition for each pair of attributes with same name from both tables.

```sql
SELECT DISTINCT * FROM T1 NATURAL JOIN T2;
```

Natural Join

> **Definition**
>
> **Natural Join** does not specify a join condition and imposes an implicit EQUIJOIN condition for each pair of attributes with same name from both tables.

```
SELECT DISTINCT * FROM T1 NATURAL JOIN T2;
```

NATURAL JOIN is a shortcut. A major difference between INNER JOIN and NATURAL JOIN is the number of columns returned.

```
SELECT DISTINCT T1.rank AS rank, T1.name AS name
FROM T1 INNER JOIN T2
ON T1.name = T2.name AND T1.rank = T2.rank;
```

Natural Join Example

Rank	Name
Corporal	Punishment
Captain	Crunch
Major	Payne
General	Store

Rank	Name
Private	Payne
Captain	Crunch
Major	Minor
General	Store

Natural Join Example

Rank	Name
Corporal	Punishment
Captain	Crunch
Major	Payne
General	Store

Rank	Name
Private	Payne
Captain	Crunch
Major	Minor
General	Store

Rank	Name
Captain	Crunch
General	Store