Introduction to Database Systems
Lecture 10

Engr. Madeha Mushtaq
Department of Computer Science
Iqra National University

JOIN Operation

- The JOIN operation, denoted by ⋈, is used to combine *related tuples* from two relations into single "longer" tuples.
- JOIN operation combines rows from two or more tables.
- JOIN operation allows us to process relationships among relations.

Types of SQL JOIN

- EQUI JOIN
  - EQUI JOIN is a simple SQL join.
  - Uses the equal sign(=) as the comparison operator for the condition
- NON EQUI JOIN
  - NON EQUI JOIN uses comparison operator other than the equal sign.
  - The operators uses like >, <, >=, <= with the condition.

Types of SQL EQUI JOIN

- INNER JOIN
  - Returns only matched rows from the participating tables.
  - Match happened only at the key record of participating tables.
- OUTER JOIN
  - Returns all rows from one table and
  - Matching rows from the secondary table and
  - Comparison columns should be equal in both the tables.

List of SQL JOINS

- INNER JOIN
- LEFT JOIN OR LEFT OUTER JOIN
- RIGHT JOIN OR RIGHT OUTER JOIN
- FULL OUTER JOIN
- NATURAL JOIN
- CROSS JOIN
- SELF JOIN

Inner join

- The INNER JOIN selects all rows from both participating tables as long as there is a match between the columns.
- An SQL INNER JOIN is same as JOIN clause, combining rows from two or more tables.
- Example:
  - SELECT * FROM table_A INNER JOIN table_B ON table_A.A=table_B.A;

Inner join

- Common attributes need not to have same name, but must have same domain.
- Applied generally between tables having referential integrity between them.
- INNER JOIN clause is an alternative to WHERE clause, and is used to match primary and foreign keys.
- An INNER join will only return rows from each table that have matching rows in the other.

	crCode	crName	crCrdts	prName
1	CS-105	Intro to Programmin...	4	BCS
2	CS-216	Data Structures	4	BCS
3	CS-316	Database Systems	4	BCS
4	CS-504	Analysis of Algorit...	4	MCS
5	CS-511	Operating System	4	MCS
6	CS-516	Data Structures and...	4	MCS
7	CS-616	Intro to Database S...	3	MCS
8	MG-103	Intro to Management...	NULL	NULL
9	MG-105	Intro to Accounting...	3	BBA
10	MG-314	Money & Capital Mar...	3	BIT
11	MG-505	Intro to Accounting...	3	MBA
12	MT-305	Linear Algebra	3	MCS

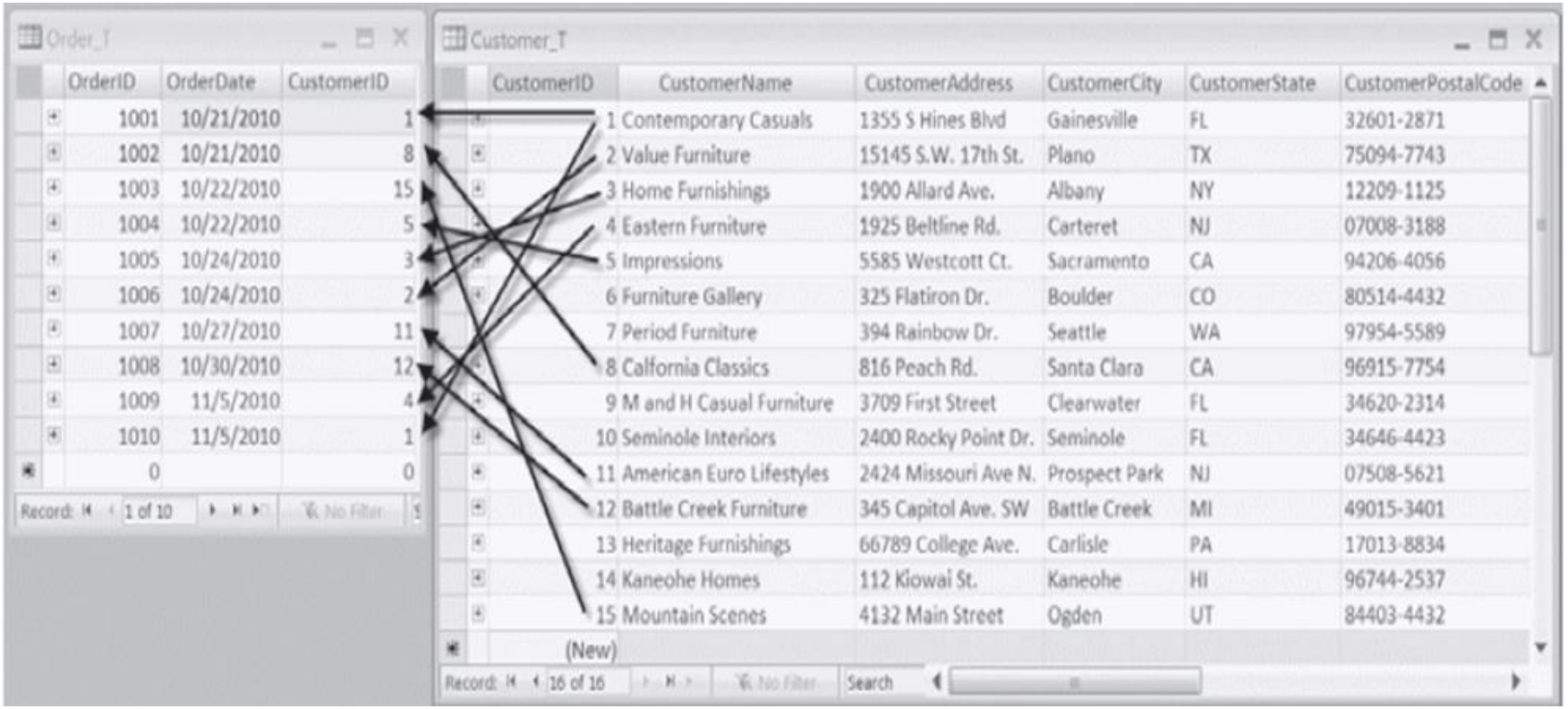
	prName	totSem	prCredits
1	BBA	8	130
2	BCS	8	134
3	BIT	8	132
4	MBA	4	64
5	MCS	4	64

Inner Join

- SELECT * FROM course INNER JOIN program
  ON course.prName = program.prName
- Select * FROM Course c inner join program p
  ON c.prName = p.prName

	crCode	crName	crCrdts	prName	prName	totSem	prCredits
1	CS-105	Intro to Programming	4	BCS	BCS	8	134
2	CS-216	Data Structures	4	BCS	BCS	8	134
3	CS-316	Database Systems	4	BCS	BCS	8	134
4	CS-504	Analysis of Algorithm	4	MCS	MCS	4	64
5	CS-511	Operating System	4	MCS	MCS	4	64
6	CS-516	Data Structures and Algos	4	MCS	MCS	4	64
7	CS-616	Intro to Database Systems	3	MCS	MCS	4	64
8	MG-105	Intro to Accounting	3	BBA	BBA	8	130
9	MG-314	Money & Capital Mark	3	BIT	BIT	8	132
10	MG-505	Intro to Accounting	3	MBA	MBA	4	64
11	MT-305	Linear Algebra	3	MCS	MCS	4	64

Inner Join



Order_T

OrderID	OrderDate	CustomerID
1001	10/21/2010	1
1002	10/21/2010	8
1003	10/22/2010	15
1004	10/22/2010	5
1005	10/24/2010	3
1006	10/24/2010	2
1007	10/27/2010	11
1008	10/30/2010	12
1009	11/5/2010	4
1010	11/5/2010	1
0		0

Record: 1 of 10

Customer_T

CustomerID	CustomerName	CustomerAddress	CustomerCity	CustomerState	CustomerPostalCode
1	Contemporary Casuals	1355 S Hines Blvd	Gainesville	FL	32601-2871
2	Value Furniture	15145 S.W. 17th St.	Plano	TX	75094-7743
3	Home Furnishings	1900 Allard Ave.	Albany	NY	12209-1125
4	Eastern Furniture	1925 Beltline Rd.	Carteret	NJ	07008-3188
5	Impressions	5585 Westcott Ct.	Sacramento	CA	94206-4056
6	Furniture Gallery	325 Flatiron Dr.	Boulder	CO	80514-4432
7	Period Furniture	394 Rainbow Dr.	Seattle	WA	97954-5589
8	Calfornia Classics	816 Peach Rd.	Santa Clara	CA	96915-7754
9	M and H Casual Furniture	3709 First Street	Clearwater	FL	34620-2314
10	Seminole Interiors	2400 Rocky Point Dr.	Seminole	FL	34646-4423
11	American Euro Lifestyles	2424 Missouri Ave N.	Prospect Park	NJ	07508-5621
12	Battle Creek Furniture	345 Capitol Ave. SW	Battle Creek	MI	49015-3401
13	Heritage Furnishings	66789 College Ave.	Carlisle	PA	17013-8834
14	Kaneohe Homes	112 Kiowai St.	Kaneohe	HI	96744-2537
15	Mountain Scenes	4132 Main Street	Ogden	UT	84403-4432
(New)					

Record: 16 of 16 Search

Inner Join

```
SELECT Customer_T.CustomerID, Order_T.CustomerID,
   CustomerName, OrderID
FROM Customer_T INNER JOIN Order_T ON
   Customer_T.CustomerID = Order_T.CustomerID
ORDER BY OrderID;
```

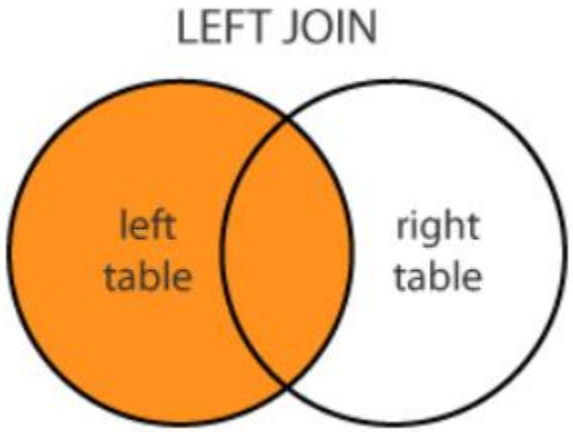
Result:

CUSTOMERID	CUSTOMERID	CUSTOMERNAME	ORDERID
1	1	Contemporary Casuals	1001
8	8	California Classics	1002
15	15	Mountain Scenes	1003
5	5	Impressions	1004
3	3	Home Furnishings	1005
2	2	Value Furniture	1006
11	11	American Euro Lifestyles	1007
12	12	Battle Creek Furniture	1008
4	4	Eastern Furniture	1009
1	1	Contemporary Casuals	1010

10 rows selected.

LEFT OUTER JOIN

- The LEFT JOIN keyword returns all records from the left table (table1), and the matched records from the right table (table2).
- Example:
  - SELECT * FROM table_A LEFT JOIN table_B ON table_A.A=table_B.A;



LEFT OUTER JOIN

- List the customer name, ID number, and order number for all customers. Include customer information even for customers that do have an order.
- LEFT OUTER JOIN clause causes customer data to appear even if there is no corresponding order data.

```
SELECT Customer_T.CustomerID, CustomerName, OrderID
  FROM Customer_T LEFT OUTER JOIN Order_T
  WHERE Customer_T.CustomerID = Order_T. CustomerID;
```

LEFT OUTER JOIN

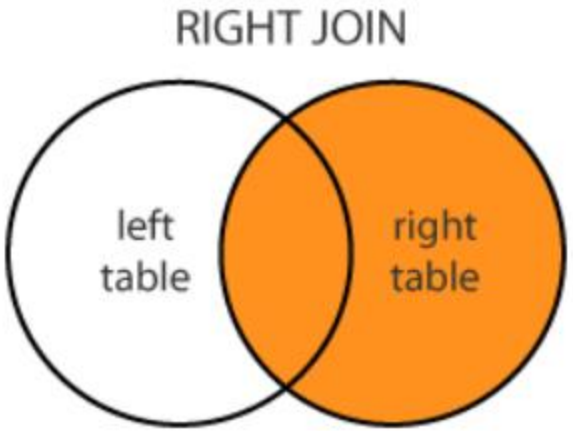
Unlike INNER join, this will include customer rows with no matching order rows.

CUSTOMERID	CUSTOMERNAME	ORDERID
1	Contemporary Casuals	1001
1	Contemporary Casuals	1010
2	Value Furniture	1006
3	Home Furnishings	1005
4	Eastern Furniture	1009
5	Impressions	1004
6	Furniture Gallery	
7	Period Furniture	
8	California Classics	1002
9	M & H Casual Furniture	
10	Seminole Interiors	
11	American Euro Lifestyles	1007
12	Battle Creek Furniture	1008
13	Heritage Furnishings	
14	Kaneohe Homes	
15	Mountain Scenes	1003

16 rows selected.

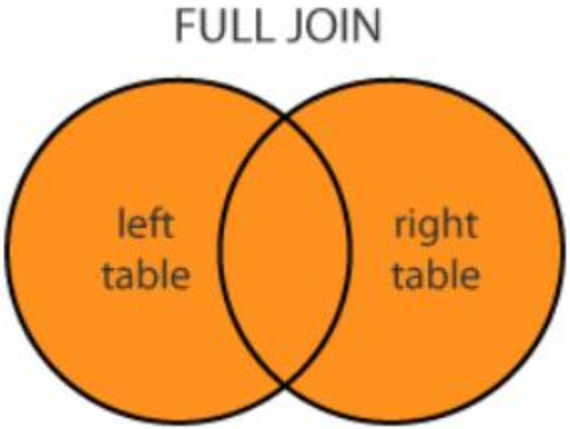
RIGHT OUTER JOIN

- The RIGHT JOIN keyword returns all records from the right table (table2), and the matched records from the left table (table1).
- Example:
  - SELECT * FROM table_A RIGHT JOIN table_B ON table_A.A=table_B.A;



FULL OUTER JOIN

- FULL JOIN returns all matching records from both tables whether the other table matches or not.
- FULL JOIN can potentially return very large datasets.
- FULL JOIN and FULL OUTER JOIN are the same.
- Example: SELECT * FROM table_A FULL OUTER JOIN table_B ON table_A.A=table_B.A;



FULL OUTER JOIN

- A Left Outer Join B = B Right Outer Join A
- Missing values are replaced with NULLs
- Full Outer Join: Inner join plus the non-matching rows from both tables

Outer Join Examples

- Select * from course c LEFT OUTER JOIN program p on c.prName = p.prName
- Select * from program p RIGHT OUTER JOIN course c on c.prName = p.prName

	crCode	crName	crCrdts	prName	prName	totSem	prCredits
1	CS-105	Intro to Programming	4	BCS	BCS	8	134
2	CS-216	Data Structures	4	BCS	BCS	8	134
3	CS-316	Database Systems	4	BCS	BCS	8	134
4	CS-504	Analysis of Algorithm	4	MCS	MCS	4	64
5	CS-511	Operating System	4	MCS	MCS	4	64
6	CS-516	Data Structures and Algos	4	MCS	MCS	4	64
7	CS-616	Intro to Database Systems	3	MCS	MCS	4	64
8	MG-103	Intro to Management	NULL	NULL	NULL	NULL	NULL
9	MG-105	Intro to Accounting	3	BBA	BBA	8	130
10	MG-314	Money & Capital Mark	3	BIT	BIT	8	132
11	MG-505	Intro to Accounting	3	MBA	MBA	4	64
12	MT-305	Linear Algebra	3	MCS	MCS	4	64

	crCode	crName	crCrdts	prName	prName	totSem	prCredits
1	MG-105	Intro to Accounting...	3	BBA	BBA	8	130
2	CS-105	Intro to Programmin...	4	BCS	BCS	8	134
3	CS-216	Data Structures	4	BCS	BCS	8	134
4	CS-316	Database Systems	4	BCS	BCS	8	134
5	MG-314	Money & Capital Mar...	3	BIT	BIT	8	132
6	MG-505	Intro to Accounting...	3	MBA	MBA	4	64
7	CS-504	Analysis of Algorit...	4	MCS	MCS	4	64
8	CS-511	Operating System	4	MCS	MCS	4	64
9	CS-516	Data Structures and...	4	MCS	MCS	4	64
10	CS-616	Intro to Database S...	3	MCS	MCS	4	64
11	MT-305	Linear Algebra	3	MCS	MCS	4	64
12	NULL	NULL	NULL	NULL	MIT	4	62

NATURAL JOIN

- The SQL NATURAL JOIN is a type of EQUI JOIN and is structured in such a way that, columns with same name of associate tables will appear once only.
- The associated tables have one or more pairs of identically named columns.
- The columns must be the same data type.
- Don’t use ON clause in a natural join.
- Example:
  - SELECT * FROM table_A NATURAL JOIN table_B;

CROSS JOIN

- The SQL CROSS JOIN produces a result set which is the number of rows in the first table multiplied by the number of rows in the second table.
- If no WHERE clause is used along with CROSS JOIN, This kind of result is called as Cartesian Product.
- If, WHERE clause is used with CROSS JOIN, it functions like an INNER JOIN.
- Example:
  - SELECT * FROM table_A CROSS JOIN table_B;

SELF JOIN

- A self JOIN is a regular join, but the table is joined with itself.
- This can be useful when modeling hierarchies.
- They are also useful for comparisons within a table.
- Example:
  - SELECT * FROM table_A X, table_A Y WHERE X.A=Y.A;
- X and Y are different table aliases for the same table.

Self-Join Example

Query: What are the employee ID and name of each employee and the name of his or her supervisor (label the supervisor's name Manager)?

```
SELECT E.EmployeeID, E.EmployeeName, M.EmployeeName AS Manager
  FROM Employee_T E, Employee_T M
  WHERE E.EmployeeSupervisor = M.EmployeeID;
```

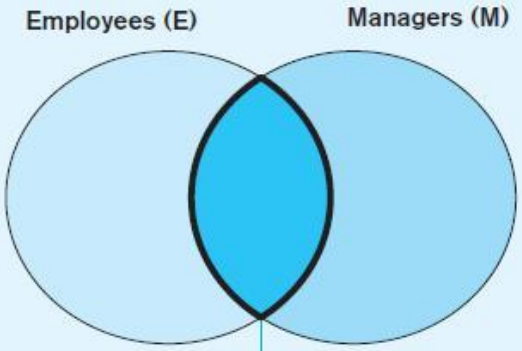
The same table is used on both sides of the join; distinguished using table aliases

Result:

EMPLOYEEID	EMPLOYEENAME	MANAGER
123-44-347	Jim Jason	Robert Lewis

- Self-joins are usually used on tables with unary relationships.

Self Join Example



Employees who have supervisors; i.e.,
WHERE E.EmployeeSupervisor = M.EmployeeID

Employees (E)

EmployeeID	EmployeeName	EmployeeSupervisor
098-23-456	Sue Miller	
107-55-789	Stan Getz	
123-44-347	Jim Jason	678-44-546
547-33-243	Bill Blass	
678-44-546	Robert Lewis	

Managers (M)

EmployeeID	EmployeeName	EmployeeSupervisor
098-23-456	Sue Miller	
107-55-789	Stan Getz	
123-44-347	Jim Jason	678-44-546
547-33-243	Bill Blass	
678-44-546	Robert Lewis	

End of Slides