

Oracle 11g - SQL

Displaying Data from Multiple Tables

Objectives

After completing this lesson, you should be able to do the following:

- Types of Joins Using SQL:1999 Syntax
- Write `SELECT` statements to access data from more than one table using equijoins and non-equijoins
- Join a table to itself by using a self-join
- View data that generally does not meet a join condition by using outer joins

Obtaining Data from Multiple Tables

EMPLOYEES

	EMPLOYEE_ID	LAST_NAME	DEPARTMENT_ID
1	200	Whalen	10
2	201	Hartstein	20
3	202	Fay	20
4	205	Higgins	110
...			
18	174	Abel	80
19	176	Taylor	80
20	178	Grant	(null)

DEPARTMENTS

	DEPARTMENT_ID	DEPARTMENT_NAME	LOCATION_ID
1	10	Administration	1700
2	20	Marketing	1800
3	50	Shipping	1500
4	60	IT	1400
5	80	Sales	2500
6	90	Executive	1700
7	110	Accounting	1700
8	190	Contracting	1700



	EMPLOYEE_ID	DEPARTMENT_ID	DEPARTMENT_NAME
1	100	90	Executive
2	101	90	Executive
...			
17	202	20	Marketing
18	205	110	Accounting
19	206	110	Accounting

Types of Joins

Joins that are compliant with the SQL:1999 standard include the following:

- Cross joins
- Natural joins
- USING clause
- Full (or two-sided) outer joins
- Arbitrary join conditions for outer joins

Joining Tables Using SQL:1999 Syntax

Use a join to query data from more than one table:

```
SELECT    table1.column, table2.column
FROM      table1
[NATURAL JOIN table2] |
[JOIN table2 USING (column_name)] |
[JOIN table2
    ON (table1.column_name = table2.column_name)] |
[LEFT|RIGHT|FULL OUTER JOIN table2
    ON (table1.column_name = table2.column_name)] |
[CROSS JOIN table2];
```

Creating Natural Joins

- The `NATURAL JOIN` clause is based on all columns in the two tables that have the same name.
- It selects rows from the two tables that have equal values in all matched columns.
- If the columns having the same names have different data types, an error is returned.

Retrieving Records with Natural Joins

```
SELECT department_id, department_name,  
       location_id, city  
FROM   departments  
NATURAL JOIN locations ;
```

	DEPARTMENT_ID	DEPARTMENT_NAME	LOCATION_ID	CITY
1	60	IT	1400	Southlake
2	50	Shipping	1500	South San Francisco
3	10	Administration	1700	Seattle
4	90	Executive	1700	Seattle
5	110	Accounting	1700	Seattle
6	190	Contracting	1700	Seattle
7	20	Marketing	1800	Toronto
8	80	Sales	2500	Oxford

Creating Joins with the USING Clause

- If several columns have the same names but the data types do not match, natural join can be applied by using the `USING` clause to specify the columns that should be used for an equijoin.
- Use the `USING` clause to match only one column when more than one column matches.
- Do not use a table name or alias in the referenced columns.
- The `NATURAL JOIN` and `USING` clauses are mutually exclusive.

Joining Column Names

EMPLOYEES

	EMPLOYEE_ID	DEPARTMENT_ID
1	200	10
2	201	20
3	202	20
4	205	110
5	206	110
6	100	90
7	101	90
8	102	90
9	103	60
10	104	60
11	107	60
12	124	50
13	141	50
14	142	50
15	143	50
16	144	50
17	149	80
18	174	80
19	176	80
20	178	(null)

DEPARTMENTS





	DEPARTMENT_ID	DEPARTMENT_NAME
1	10	Administration
2	20	Marketing
3	20	Marketing
4	50	Shipping
5	50	Shipping
6	50	Shipping
7	50	Shipping
8	50	Shipping
9	60	T
10	60	T
11	60	T
12	80	Sales
13	80	Sales
14	80	Sales
15	90	Executive
16	90	Executive
17	90	Executive
18	110	Accounting
19	110	Accounting

Foreign key

Primary key

Retrieving Records with the USING Clause

```
SELECT employees.employee_id, employees.last_name,  
       departments.location_id, department_id  
FROM   employees JOIN departments  
       USING (department_id) ;
```

	 EMPLOYEE_ID	 LAST_NAME	 LOCATION_ID	 DEPARTMENT_ID
1	200	Whalen	1700	10
2	201	Hartstein	1800	20
3	202	Fay	1800	20
4	205	Higgins	1700	110
5	206	Gietz	1700	110
6	100	King	1700	90
7	101	Kochhar	1700	90
8	102	De Haan	1700	90
9	103	Hunold	1400	60
10	104	Ernst	1400	60

...

Qualifying Ambiguous Column Names

- Use table prefixes to qualify column names that are in multiple tables.
- Use table prefixes to improve performance.
- Use column aliases to distinguish columns that have identical names but reside in different tables.
- Do not use aliases on columns that are identified in the `USING` clause and listed elsewhere in the SQL statement.

Using Table Aliases

- Use table aliases to simplify queries.
- Use table aliases to improve performance.

```
SELECT e.employee_id, e.last_name,  
       d.location_id, department_id  
FROM   employees e JOIN departments d  
USING (department_id) ;
```

Creating Joins with the ON Clause

- The join condition for the natural join is basically an equijoin of all columns with the same name.
- Use the ON clause to specify arbitrary conditions or specify columns to join.
- The join condition is separated from other search conditions.
- The ON clause makes code easy to understand.

Retrieving Records with the ON Clause

```
SELECT e.employee_id, e.last_name, e.department_id,  
       d.department_id, d.location_id  
FROM   employees e JOIN departments d  
ON     (e.department_id = d.department_id);
```

	EMPLOYEE_ID	LAST_NAME	DEPARTMENT_ID	DEPARTMENT_ID_1	LOCATION_ID
1	200	Whalen	10	10	1700
2	201	Hartstein	20	20	1800
3	202	Fay	20	20	1800
4	205	Higgins	110	110	1700
5	206	Gietz	110	110	1700
6	100	King	90	90	1700
7	101	Kochhar	90	90	1700
8	102	De Haan	90	90	1700
9	103	Hunold	60	60	1400
10	104	Ernst	60	60	1400

...

Self-Joins Using the ON Clause

EMPLOYEES (WORKER)

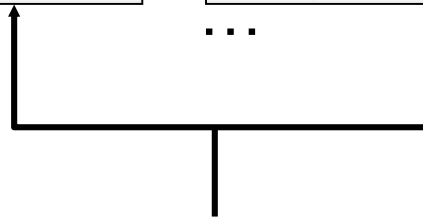
	EMPLOYEE_ID	LAST_NAME	MANAGER_ID
1	100	King	(null)
2	101	Kochhar	100
3	102	De Haan	100
4	103	Hunold	102
5	104	Ernst	103
6	107	Lorentz	103
7	124	Mourgos	100
8	141	Rajs	124
9	142	Davies	124
10	143	Matos	124

...

EMPLOYEES (MANAGER)

	EMPLOYEE_ID	LAST_NAME
1	100	King
2	101	Kochhar
3	102	De Haan
4	103	Hunold
5	104	Ernst
6	107	Lorentz
7	124	Mourgos
8	141	Rajs
9	142	Davies
10	143	Matos

...



MANAGER_ID in the WORKER table is equal to
EMPLOYEE_ID in the MANAGER table.

Self-Joins Using the ON Clause

```
SELECT e.last_name emp, m.last_name mgr
FROM   employees e JOIN employees m
ON     (e.manager_id = m.employee_id);
```

	EMP	MGR
1	Abel	Zlotkey
2	Davies	Mourgos
3	De Haan	King
4	Ernst	Hunold
5	Fay	Hartstein
6	Gietz	Higgins
7	Grant	Zlotkey
8	Hartstein	King

...

Applying Additional Conditions to a Join

```
SELECT e.employee_id, e.last_name, e.department_id,  
       d.department_id, d.location_id  
FROM   employees e JOIN departments d  
ON     (e.department_id = d.department_id)  
AND    e.manager_id = 149 ;
```

	EMPLOYEE_ID	LAST_NAME	DEPARTMENT_ID	DEPARTMENT_ID_1	LOCATION_ID
1	174	Abel	80	80	2500
2	176	Taylor	80	80	2500

Creating Three-Way Joins with the ON Clause

```
SELECT employee_id, city, department_name
FROM   employees e
JOIN   departments d
ON     d.department_id = e.department_id
JOIN   locations l
ON     d.location_id = l.location_id;
```

	EMPLOYEE_ID	CITY	DEPARTMENT_NAME
1	100	Seattle	Executive
2	101	Seattle	Executive
3	102	Seattle	Executive
4	103	Southlake	IT
5	104	Southlake	IT
6	107	Southlake	IT
7	124	South San Francisco	Shipping
8	141	South San Francisco	Shipping

...

Nonequijoins

EMPLOYEES

	R2	LAST_NAME	R2	SALARY
1		Whalen		4400
2		Hartstein		13000
3		Fay		6000
4		Higgins		12000
5		Gietz		8300
6		King		24000
7		Kochhar		17000
8		De Haan		17000
9		Hunold		9000
10		Ernst		6000

...

JOB_GRADES

	R2	GRADE_LEVEL	R2	LOWEST_SAL	R2	HIGHEST_SAL
1		A		1000		2999
2		B		3000		5999
3		C		6000		9999
4		D		10000		14999
5		E		15000		24999
6		F		25000		40000

← Salary in the EMPLOYEES table must be between lowest salary and highest salary in the JOB_GRADES table.

Retrieving Records with Nonequijoins

```
SELECT e.last_name, e.salary, j.grade_level
FROM   employees e JOIN job grades j
ON     e.salary
      BETWEEN j.lowest_sal AND j.highest_sal;
```

	LAST_NAME	SALARY	GRADE_LEVEL
1	Vargas	2500	A
2	Matos	2600	A
3	Davies	3100	B
4	Rajs	3500	B
5	Lorentz	4200	B
6	Whalen	4400	B
7	Mourgos	5800	B
8	Ernst	6000	C

...

Outer Joins

DEPARTMENTS

	DEPARTMENT_NAME	DEPARTMENT_ID
1	Administration	10
2	Marketing	20
3	Shipping	50
4	IT	60
5	Sales	80
6	Executive	90
7	Accounting	110
8	Contracting	190

EMPLOYEES

	DEPARTMENT_ID	LAST_NAME
1	10	Whalen
2	20	Hartstein
3	20	Fay
4	110	Higgins
5	110	Gietz
6	90	King
7	90	Kochhar
8	90	De Haan
9	60	Hunold
10	60	Ernst

...

There are no employees in department 190.

INNER Versus OUTER Joins

- In SQL:1999, the join of two tables returning only matched rows is called an inner join.
- A join between two tables that returns the results of the inner join as well as the unmatched rows from the left (or right) tables is called a left (or right) outer join.
- A join between two tables that returns the results of an inner join as well as the results of a left and right join is a full outer join.

LEFT OUTER JOIN

```
SELECT e.last_name, e.department_id, d.department_name
FROM   employees e LEFT OUTER JOIN departments d
ON     (e.department_id = d.department_id) ;
```

	LAST_NAME	DEPARTMENT_ID	DEPARTMENT_NAME
1	Whalen	10	Administration
2	Hartstein	20	Marketing
3	Fay	20	Marketing
4	Higgins	110	Accounting

...

18	Abel	80	Sales
19	Taylor	80	Sales
20	Grant	(null)	(null)

RIGHT OUTER JOIN

```
SELECT e.last_name, e.department_id, d.department_name
FROM   employees e RIGHT OUTER JOIN departments d
ON     (e.department_id = d.department_id) ;
```

	LAST_NAME	DEPARTMENT_ID	DEPARTMENT_NAME
1	Whalen	10	Administration
2	Hartstein	20	Marketing
3	Fay	20	Marketing

...

18	Higgins	110	Accounting
19	Gietz	110	Accounting
20	(null)	(null)	Contracting

FULL OUTER JOIN

```
SELECT e.last_name, d.department_id, d.department_name
FROM   employees e FULL OUTER JOIN departments d
ON     (e.department_id = d.department_id) ;
```

	LAST_NAME	DEPARTMENT_ID	DEPARTMENT_NAME
1	Whalen	10	Administration
2	Hartstein	20	Marketing
3	Fay	20	Marketing

...

18	Abel	80	Sales
19	Taylor	80	Sales
20	Grant	(null) (null)	
21	(null)	190	Contracting