Retrieving Data by Using Subqueries

Objectives

After completing this lesson, you should be able to:

- Write a multiple-column subquery
- Use scalar subqueries in SQL
- Solve problems with correlated subqueries
- Use the `EXISTS` and `NOT EXISTS` operators
- Use the `WITH` clause

Retrieving Data by Using a Subquery as a Source

```
SELECT department_name, city
FROM   departments
NATURAL JOIN (SELECT l.location_id, l.city, l.country_id
              FROM   locations l
              JOIN   countries c
              ON(l.country_id = c.country_id)
              JOIN regions
              USING(region_id)
              WHERE region_name = 'Europe');
```

	DEPARTMENT_NAME	CITY
1	Human Resources	London
2	Sales	Oxford
3	Public Relations	Munich

Lesson Agenda

- Retrieving data by using a subquery as a source
- Writing a multiple-column subquery
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Multiple-Column Subqueries

Main query

```
WHERE (MANAGER_ID, DEPARTMENT_ID)  IN
```

Subquery

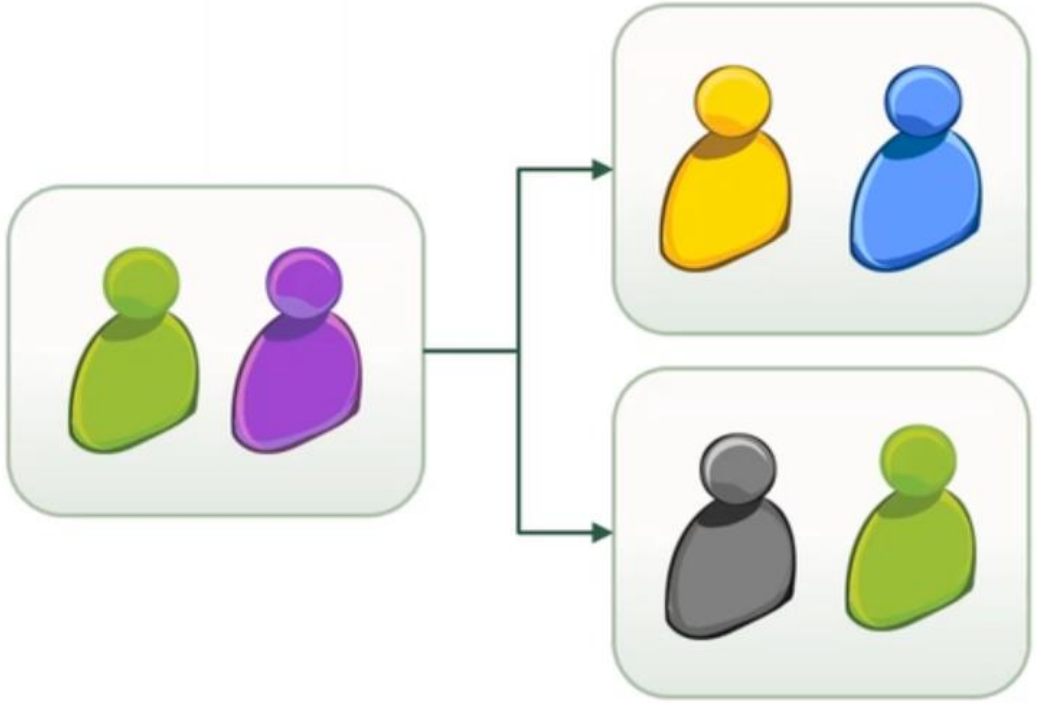
100	90
102	60
124	50

Each row of the main query is compared to values from a multiple-row and multiple-column subquery.

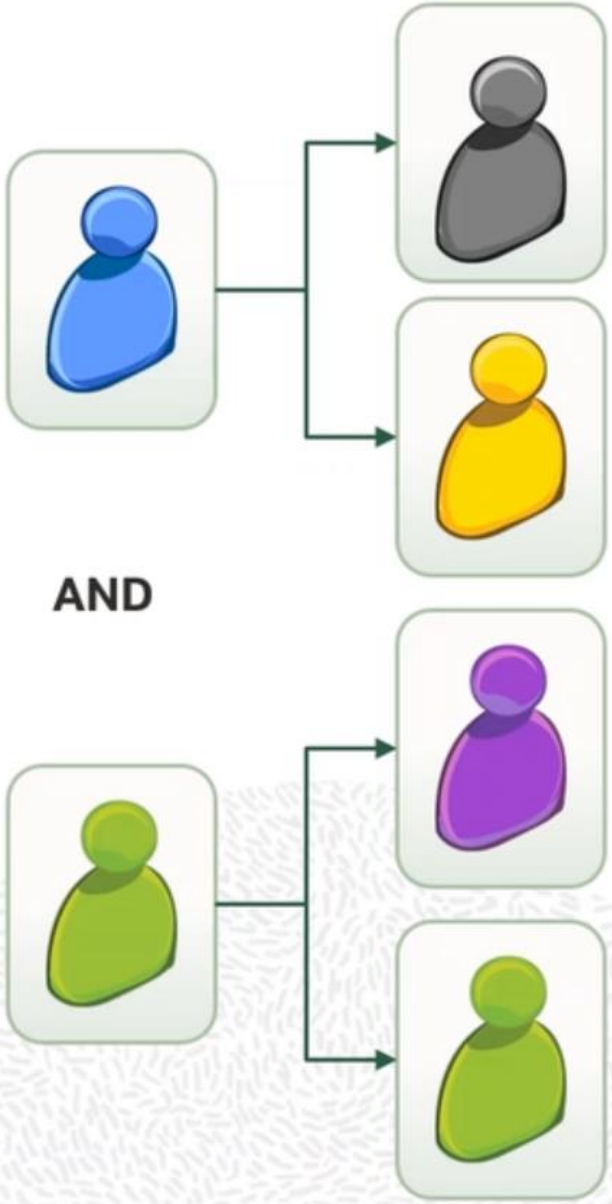
Column Comparisons

Multiple-column comparisons involving subqueries can be:

- Pairwise comparisons
- Nonpairwise comparisons



Pairwise comparisons



Nonpairwise comparisons

Pairwise Comparison Subquery

Display the details of the employees who are managed by the same manager and work in the same department as the employees with `EMPLOYEE_ID` 199 or 174.

```
SELECT employee_id, manager_id, department_id
FROM employees
WHERE (manager_id, department_id) IN
                              (SELECT manager_id, department_id
                               FROM employees
                               WHERE employee_id IN (174, 199))
AND employee_id NOT IN (174,199);
```

	EMPLOYEE_ID	MANAGER_ID	DEPARTMENT_ID
1	141	124	50
2	142	124	50
3	143	124	50
4	144	124	50

...

Nonpairwise Comparison Subquery

Display the details of the employees who are managed by the same manager as the employees with `EMPLOYEE_ID` 174 or 141 and work in the same department as the employees with `EMPLOYEE_ID` 174 or 141.

```
SELECT employee_id, manager_id, department_id
FROM employees
WHERE manager_id IN
                  (SELECT manager_id
                   FROM employees
                   WHERE employee_id IN (174,141))
AND department_id IN
                  (SELECT department_id
                   FROM employees
                   WHERE employee_id IN (174,141))
AND employee_id NOT IN(174,141);
```

	EMPLOYEE_ID	MANAGER_ID	DEPARTMENT_ID
1	142	124	50
2	143	124	50

Scalar Subquery Expressions

- A scalar subquery is a subquery that returns exactly one column value from one row.
- Scalar subqueries can be used in:
  - The condition and expression part of `DECODE` and `CASE`
  - All clauses of `SELECT` except `GROUP BY`
  - The `SET` clause and `WHERE` clause of an `UPDATE` statement

Scalar Subqueries: Examples

- Scalar subqueries in CASE expressions:

```
SELECT employee_id, last_name,
       (CASE
        WHEN department_id =
                (SELECT department_id
                 FROM departments
                 WHERE location_id = 1800)
         THEN 'Canada' ELSE 'USA' END) location
FROM   employees;
```

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- Scalar subqueries in the SELECT statement:

```
select department_id, department_name,
      (select count(*)
       from   employees e
       where  e.department_id = d.department_id) as emp_count
from   departments d;
```

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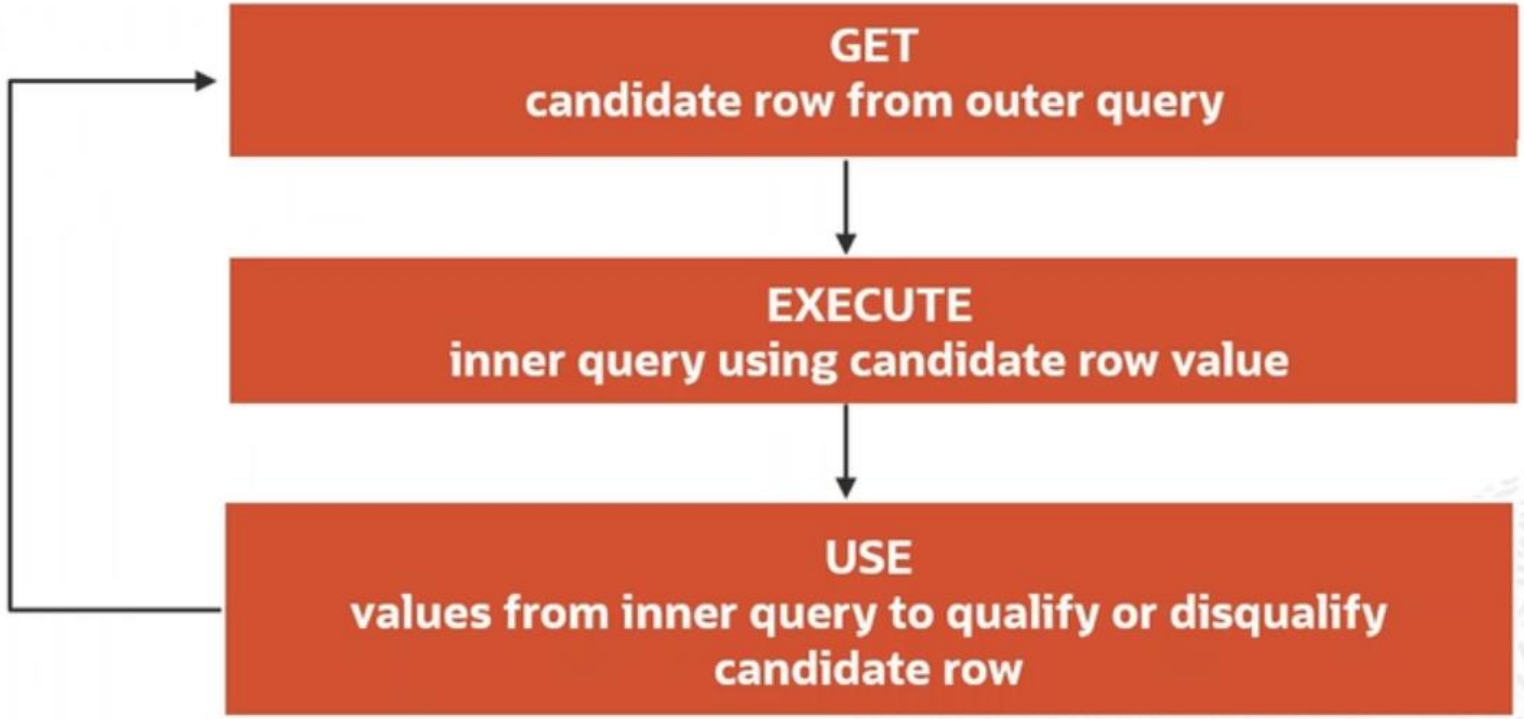
Correlated Subqueries

Correlated subqueries are used for row-by-row processing. Each subquery is executed once for every row of the outer query.



Correlated Subqueries

The subquery references a column from a table in the parent query.

Parent Query

```
SELECT column1, column2, ...
FROM   table1 Outer_table
WHERE  column1 operator
                (SELECT  column1, column2
                      FROM     table2
                      WHERE    expr1 =
    Outer_table.expr2);
```

Subquery

Using Correlated Subqueries: Example 1

Find all employees who earn more than the average salary in their department.

```
SELECT last_name, salary, department_id
FROM   employees outer_table
WHERE  salary >
       (SELECT AVG(salary)
            FROM   employees inner_table
            WHERE inner_table.department_id =
            outer_table.department_id);
```

	LAST_NAME	SALARY	DEPARTMENT_ID
1	King	24000	90
2	Hunold	9000	60
3	Ernst	6000	60
4	Greenberg	12008	100
5	Faviet	9000	100
6	Raphaely	11000	30

....

Each time a row from the outer query is processed, the inner query is evaluated.

Using Correlated Subqueries: Example 2

Display the details of the highest earning employees in each department.

```
SELECT department_id, employee_id, salary
FROM EMPLOYEES e
WHERE salary =
      (SELECT  MAX(DISTINCT salary)
       FROM EMPLOYEES
       WHERE e.department_id = department_id);
```

	DEPARTMENT_ID	EMPLOYEE_ID	SALARY
1	90	100	24000
2	60	103	9000
3	100	108	12008
4	30	114	11000

....

Using the `EXISTS` Operator

- The `EXISTS` operator tests for existence of rows in the results set of the subquery.
- If a subquery row value is found:
  - The search does not continue in the inner query
  - The condition is flagged `TRUE`
- If a subquery row value is not found:
  - The condition is flagged `FALSE`
  - The search continues in the inner query

Syntax

```
SELECT column_name(s)
FROM table_name
WHERE EXISTS
(SELECT column_name FROM table_name WHERE condition);
```

Examples: Consider the following two relation “Customers” and “Orders”.

Customers

customer_id	lname	fname	website
401	Singh	Dolly	abc.com
402	Chauhan	Anuj	def.com
403	Kumar	Niteesh	ghi.com
404	Gupta	Shubham	jkl.com
405	Walecha	Divya	abc.com
406	Jain	Sandeep	jkl.com
407	Mehta	Rajiv	abc.com
408	Mehra	Anand	abc.com

Orders Table

Orders

order_id	c_id	order_date
1	407	2017-03-03
2	405	2017-03-05
3	408	2017-01-18
4	404	2017-02-05

Using EXISTS condition with SELECT statement To fetch the first and last name of the customers who placed at least one order.

```
SELECT fname, lname FROM Customers WHERE EXISTS
 (SELECT * FROM Orders WHERE Customers.customer_id = Orders.c_id);
```

Using NOT with EXISTS Fetch last and first name of the customers who has not placed any order.

```
SELECT lname, fname FROM Customers WHERE NOT EXISTS
(SELECT * FROM Orders WHERE Customers.customer_id = Orders.c_id);
```

Using the EXISTS Operator

```
SELECT employee_id, last_name, job_id, department_id
FROM   employees outer
WHERE  EXISTS ( SELECT NULL
                FROM   employees
                WHERE  manager_id =
                       outer.employee_id);
```

	EMPLOYEE_ID	LAST_NAME	JOB_ID	DEPARTMENT_ID
1	100	King	AD_PRES	90
2	101	Kochhar	AD_VP	90
3	102	De Haan	AD_VP	90
4	103	Hunold	IT_PROG	60
5	108	Greenberg	FI_MGR	100
6	114	Raphaely	PU_MAN	30
7	120	Weiss	ST_MAN	50
8	121	Fripp	ST_MAN	50

...

Find All Departments That Do Not Have Any Employees

```
SELECT department_id, department_name
FROM departments d
WHERE NOT EXISTS (SELECT NULL
                  FROM   employees
                  WHERE  department_id = d.department_id);
```

	DEPARTMENT_ID	DEPARTMENT_NAME
1	120	Treasury
2	130	Corporate Tax
3	140	Control And Credit
4	150	Shareholder Services
5	160	Benefits
6	170	Manufacturing
7	180	Construction
8	190	Contracting
9	200	Operations
10	210	IT Support

...

All Rows Fetched: 16

WITH Clause

- Using the WITH clause, you can use the same query block in a SELECT statement when it occurs more than once within a complex query.
- The WITH clause retrieves the results of a query block and stores them in the user's temporary tablespace.
- The WITH clause can improve performance.

WITH Clause: Example

```
WITH CNT_DEPT AS
(
SELECT department_id,
 COUNT(*) NUM_EMP
FROM EMPLOYEES
GROUP BY department_id
)
SELECT employee_id,
 SALARY/NUM_EMP
FROM EMPLOYEES E
JOIN CNT_DEPT C
ON (e.department_id = c.department_id);
```

	EMPLOYEE_ID	SALARY/NUM_EMP
1	100	8000
2	103	1800
3	108	2001.3333333333333333333333333333333333
4	110	1366.6666666666666666666666666666666667
5	114	1833.3333333333333333333333333333333333
6	137	80
7	139	60

Summary

In this lesson, you should have learned how to:

- Write a multiple-column subquery
- Use scalar subqueries in SQL
- Solve problems with correlated subqueries
- Use the `EXISTS` and `NOT EXISTS` operators
- Use the `WITH` clause