Subquery II.

Objectives

- After completing this lesson, you should be able to do the following:
  - Write a multiple-column subquery
  - Use scalar subqueries in SQL
  - Solve problems with correlated subqueries
  - Update and delete rows using correlated subqueries
  - Use the **`EXISTS`** and **`NOT EXISTS`** operators
  - Use the **`WITH`** clause

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

- Column comparisons in a multiple-column subquery can be:
  - 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 (199,174))
AND     employee_id NOT IN (199,174);
```

Nonpairwise Comparison Subquery

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

```
SELECT   employee_id, manager_id, department_id
FROM     employees
WHERE    manager_id IN
                      (SELECT  manager_id
                       FROM    employees
                       WHERE   employee_id IN (174,199))
AND      department_id IN
                      (SELECT  department_id
                       FROM    employees
                       WHERE   employee_id IN (174,199))

AND     employee_id NOT IN(174,199);
```

Scalar Subquery Expressions

- A scalar subquery expression is a subquery that returns exactly one column value from one row.
- Scalar subqueries can be used in:
  - Condition and expression part of `DECODE` and `CASE`
  - All clauses of `SELECT` except `GROUP BY`

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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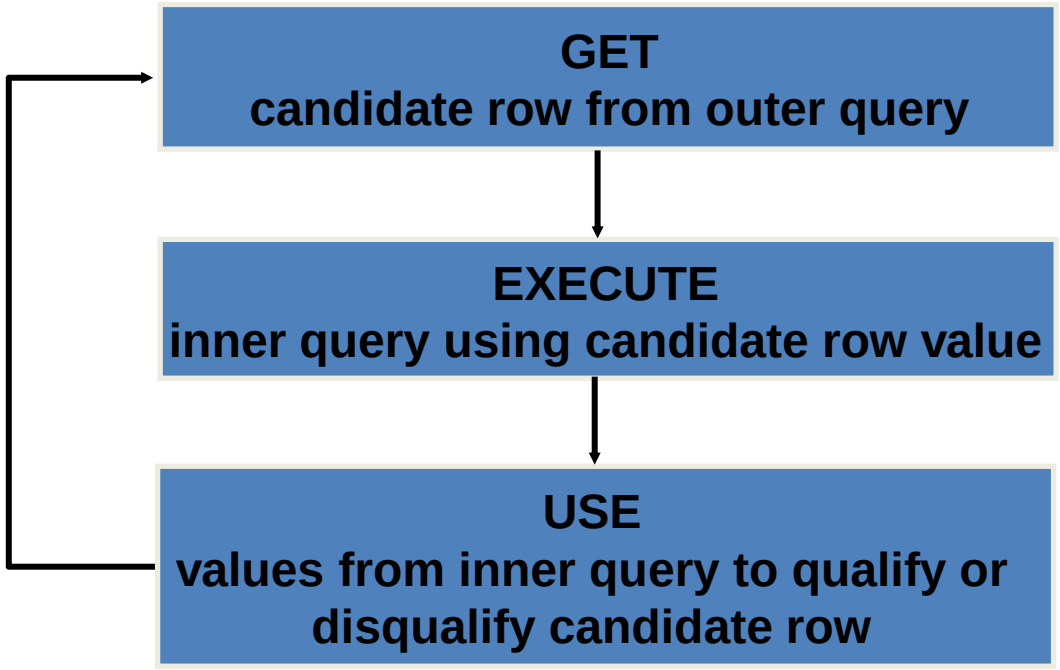
- **Scalar subqueries in ORDER BY clause**

```
SELECT   employee_id, last_name
FROM     employees e
ORDER BY (SELECT department_name
          FROM departments d
           WHERE e.department_id = d.department_id);
```

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.

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

Using Correlated Subqueries

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

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

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

Using Correlated Subqueries

Display details of those employees who have changed jobs at least twice.

```
SELECT e.employee_id, last_name,e.job_id
FROM   employees e
WHERE  2 <= (SELECT COUNT(*)
             FROM   job_history
             WHERE  employee_id = e.employee_id);
```

EMPLOYEE_ID	LAST_NAME	JOB_ID
101	Kochhar	AD_VP
176	Taylor	SA_REP
200	Whalen	AD_ASST

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

Find Employees Who Have at Least One Person Reporting to Them

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

EMPLOYEE_ID	LAST_NAME	JOB_ID	DEPARTMENT_ID
100	King	AD_PRES	90
101	Kochhar	AD_VP	90
102	De Haan	AD_VP	90
103	Hunold	IT_PROG	60
108	Greenberg	FI_MGR	100
114	Raphaely	PU_MAN	30
120	Weiss	ST_MAN	50
121	Fripp	ST_MAN	50
122	Kaufling	ST_MAN	50
123	Vollman	ST_MAN	50
124	Mourgos	ST_MAN	50
145	Russell	SA_MAN	80
146	Partners	SA_MAN	80
147	Errazuriz	SA_MAN	80
148	Cambrault	SA_MAN	80
149	Zlotkey	SA_MAN	80
201	Hartstein	MK_MAN	20
205	Higgins	AC_MGR	110

18 rows selected.

Find All Departments That Do Not Have Any Employees

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

DEPARTMENT_ID	DEPARTMENT_NAME
120	Treasury
130	Corporate Tax
140	Control And Credit
150	Shareholder Services
160	Benefits
170	Manufacturing
...	
260	Recruiting
270	Payroll

16 rows selected.

The `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 it in the user's temporary tablespace.
- The `WITH` clause improves performance.

`WITH` Clause: Example

- Using the `WITH` clause, write a query to display the department name and total salaries for those departments whose total salary is greater than the average salary across departments.

WITH Clause: Example

```
WITH
dept_costs  AS (
   SELECT d.department_name, SUM(e.salary) AS dept_total
   FROM   employees e JOIN departments d
   ON     e.department_id = d.department_id
   GROUP BY d.department_name),
avg_cost    AS (
   SELECT SUM(dept_total)/COUNT(*) AS dept_avg
   FROM   dept_costs)
SELECT *
FROM   dept_costs
WHERE  dept_total >
        (SELECT dept_avg
         FROM avg_cost)
ORDER BY department_name;
```