Database Management System (CS-2004) Lab

KALINGA INSTITUTE OF INDUSTRIAL TECHNOLOGY

School of Computer Engineering

4 Credit

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Subquery

What is Subquery - a subquery is an SQL statement that is embedded within another SQL statement. It's possible for a subquery to be embedded within another subquery, which is in turn embedded within an outermost SQL statement. Theoretically, there is no limit to the number of levels of subquery that an SQL statement may include, although any given implementation has a practical limit. A key feature of a subquery is that the table or tables that it references need not be the same as the table or tables referenced by its enclosing query. This has the effect of returning results based on the information in multiple tables.

What it does - Subqueries are located within the WHERE clause of their enclosing statement. Their function is to set the search conditions for the WHERE clause. The combination of a subquery and its enclosing query is called a nested query.

When it is used - You can use a subquery in some cases in place of a join operation by indirectly linking data between the tables based on one or more conditions. When you have a subquery in a query, the subquery is resolved first, and then the main query is resolved according to the condition(s) resolved by the subquery. The results of the subquery process expressions in the WHERE clause of the main query. You can use the subquery either in the WHERE clause or the HAVING clause of the main query. You can use logical and relational operators, such as =, >, <, <>,!=, IN, NOT IN, AND, OR, and so on, within the subquery as well as to evaluate a subquery in the WHERE or HAVING clause.

Subquery Rules

- The same rules that apply to standard queries also apply to subqueries. One can use join operations, functions, conversions, and other options within a subquery.
- Subqueries must be enclosed within parentheses. i.e. the syntax is

```
SELECT COLUMN_NAME
FROM TABLE WHERE COLUMN_NAME = (SELECT COLUMN_NAME
                                FROM TABLE WHERE CONDITIONS);
```

- A subquery can have only one column in the SELECT clause, unless multiple columns in the main query are required for the subquery to compare its selected columns.

```
SELECT COLUMN_NAME [, COLUMN_NAME ]
FROM TABLE
WHERE COLUMN_NAME = (SELECT COLUMN_NAME [, COLUMN_NAME ]
                     FROM TABLE1 WHERE CONDITIONS)
```

Subquery Rules cont...

- BETWEEN operator cannot be used with a subquery; however, BETWEEN operator can be used within the subquery.
  - **Correct** use of BETWEEN in the subquery:

    SELECT COLUMN_NAME FROM TABLE_A WHERE COLUMN_NAME OPERATOR (SELECT COLUMN_NAME FROM TABLE_B WHERE VALUE BETWEEN VALUE)
  - **Incorrect** use of BETWEEN in the subquery:

    SELECT COLUMN_NAME FROM TABLE_A

    WHERE COLUMN_NAME BETWEEN VALUE AND (SELECT COLUMN_NAME FROM TABLE_B)
- ORDER BY clause can't be used in a subquery, although the main query can use an ORDER BY clause. GROUP BY clause can be used to perform the same function as the ORDER BY clause in a subquery.
- Subqueries are employed with the **SELECT**, **INSERT**, **UPDATE**, and **DELETE** statements.

Subquery Syntax, Examples and Output

- **Syntax :**

  SELECT COLUMN_NAME FROM TABLE WHERE COLUMN_NAME =
  (SELECT COLUMN_NAME FROM TABLE WHERE CONDITIONS);

- **Example:**

  SELECT account_id, product_cd, cust_id, avail_balance FROM account
  WHERE account_id = (SELECT MAX(account_id) FROM account);

- **Output:**

  Like any query, a subquery returns a result set that may consist of:

  - A single row with a single column
  - Multiple rows with a single column
  - Multiple rows with multiple columns

Subquery with the SELECT statement

Subqueries are most frequently used with the SELECT statement, although you can use them within a data manipulation statement as well. The subquery, when employed with the SELECT statement, retrieves data for the main query to use.

Syntax :

SELECT COLUMN_NAME [, COLUMN_NAME] FROM TABLE1 [, TABLE2]

WHERE COLUMN_NAME OPERATOR

(SELECT COLUMN_NAME [, COLUMN_NAME] FROM TABLE1 [, TABLE2] [WHERE])

Example:

SELECT E.EMP_ID, E.LAST_NAME, E.FIRST_NAME, EP.PAY_RATE

FROM EMPLOYEE E, EMPLOYEE_PAY EP

WHERE E.EMP_ID = EP.EMP_ID AND EP.PAY_RATE <

(SELECT PAY_RATE FROM EMPLOYEE_PAY WHERE EMP_ID = '443679012');

Subquery with the INSERT statement

subqueries can be used in conjunction with Data Manipulation Language (DML) statements. The INSERT statement is the first instance to examine. It uses the data returned from the subquery to insert into another table.

Syntax :

```
INSERT INTO TABLE_NAME [ (COLUMN1 [, COLUMN2 ]) ]
SELECT [ *| COLUMN1 [, COLUMN2 ]
FROM TABLE1 [, TABLE2 ]
[ WHERE VALUE OPERATOR ]
```

Example:

```
INSERT INTO RICH_EMPLOYEE
SELECT E.EMP_ID, E.LAST_NAME, E.FIRST_NAME, EP.PAY_RATE
FROM EMPLOYEE E, EMPLOYEE_PAY EP WHERE E.EMP_ID = EP.EMP_ID
AND EP.PAY_RATE > (SELECT PAY_RATE FROM EMPLOYEE_PAY WHERE
                   EMP_ID = '220984332');
```

Subquery with the UPDATE statement

subqueries can be used in conjunction with the UPDATE statement to update single or multiple columns in a table.

Syntax :

```
UPDATE TABLE
SET COLUMN_NAME [, COLUMN_NAME) ] =
(SELECT ]COLUMN_NAME [, COLUMN_NAME) ]
FROM TABLE
[ WHERE ]
```

Example:

```
UPDATE EMPLOYEE_PAY
SET PAY_RATE = PAY_RATE * 1.1
WHERE EMP_ID IN (SELECT EMP_ID FROM EMPLOYEE
                 WHERE CITY = 'INDIANAPOLIS');
```

Subquery with the DELETE statement

subqueries can be used in conjunction with the DELETE statement to delete single or multiple tuples from a table.

Syntax :

```
DELETE FROM TABLE_NAME
[ WHERE OPERATOR [ VALUE ]
(SELECT COLUMN_NAME
FROM TABLE_NAME)
[ WHERE) ]
```

Example:

```
DELETE FROM EMPLOYEE_PAY
WHERE EMP_ID = (SELECT EMP_ID FROM EMPLOYEE WHERE LAST_NAME =
                'Glass' AND FIRST_NAME = 'Brandon');
```

Embedded Subqueries

Subquery can be embedded within another subquery, just as you can embed the subquery within a regular query. When a subquery is used, that subquery is resolved before the main query. Likewise, the lowest level subquery is resolved first in embedded or nested subqueries, working out to the main query.

Syntax:

```
SELECT COLUMN_NAME [, COLUMN_NAME ]
FROM TABLE1 [, TABLE2 ]
WHERE COLUMN_NAME OPERATOR (SELECT COLUMN_NAME
FROM TABLE
WHERE COLUMN_NAME OPERATOR
(SELECT COLUMN_NAME
FROM TABLE
[ WHERE COLUMN_NAME OPERATOR VALUE ]))
```

Embedded Subqueries cont...

Example:

```
SELECT CUST_ID, CUST_NAME FROM CUSTOMER
WHERE CUST_ID IN (SELECT O.CUST_ID FROM ORDERS O, PRODUCT P
WHERE O.PROD_ID = P.PROD_ID AND O.QTY + P.COST < (SELECT SUM(COST)
FROM PRODUCT));
```

Note

The use of multiple subqueries results in slower response time and might result in reduced accuracy of the results due to possible mistakes in the statement coding.

Correlated Subquery

A query is called correlated subquery when both the inner query and the outer query are interdependent. For every row processed by the inner query, the outer query is processed as well. The inner query depends on the outer query before it can be processed.

Example:

```
SELECT p.product_name FROM product p
WHERE p.product_id = (SELECT o.product_id FROM order_items o
WHERE o.product_id = p.product_id);

SELECT SUM (si.Sales) FROM Store_Information si
WHERE si.Store_ID IN
(SELECT Store_ID FROM Geography geo
WHERE geo.Store_ID = si.Store_ID);
```

Subquery with HAVING clause

Example:

```
SELECT   JobTitle, AVG(VacationHours) AS AverageVacationHours
FROM     Employee
GROUP BY JobTitle
HAVING   AVG(VacationHours) > (SELECT AVG(VacationHours)
                               FROM   Employee)
```

Example Correlated subquery:

```
SELECT   JobTitle, MaritalStatus, AVG(VacationHours)
FROM     Employee E
GROUP BY JobTitle, MaritalStatus
HAVING   AVG(VacationHours) >
        (SELECT AVG(VacationHours) FROM   Employee
         WHERE  Employee. MaritalStatus =  E.MaritalStatus)
```

ER Model

Learn Toad Data Modeler or any other ER Modeler tool of your choice and complete the problems mentioned in the assignment sections.

Thank You
End of Lab 6

Assignment

Reference Tables

- **EMPLOYEE** table with the attributes:

  ID, LAST_NAME, FIRST_NAME, MIDDLE_NAME, FATHER_NAME, MOTHER_NAME, SEX, HIRE_DATE, ADDRESS, CITY, STATE, ZIP, PHONE, PAGER, SUPERVISOR_ID, INJECTED_DATE

- **SCHOOL** table with the attributes:

  ID, NAME, INJECTED_DATE

- **EMPLOYEE _ALIGNMENT** table with the attributes:

  EMPLOYEE_ID, SCHOOL_ID, INJECTED_DATE

- **JOB** table with the attributes:

  ID, NAME, TITLE, SALARY, BONUS , INJECTED_DATE

- **EMPLOYEE _PAY** table with the attributes:

  EMPLOYEE_ID, JOB_ID, INJECTED_DATE

Assignment

Answer below questions using subqueries.

1. Display employee “Andrew Brown” school name.
2. Display full name of the supervisor for employee ID “128433”.
3. Who belongs to same school as “Rod Marsh”?
4. Who has the same title as “Stanely Garner”?
5. Which employees are working in the school longer than “Larry Houston”?
6. Find the number of employees working in school of computer engineering?
7. Find the number of employees working in school of civil engineering and as professor?
8. Find the employees with minimum salary in their own school in associate professor rank.
9. Find the employees with maximum salary in their own school in professor rank
10. Find the average salary by each school

Assignment

11. Find the number of employees earning more than the average salary by each school in Assistant Professor rank.
12. Display the employee “Jose Diaz” supervisor full name, phone and pager
13. Find the employees who don't aligned to any school
14. Find the employees who are aligned to more than one school
15. Find the employees who are more than 5 years of veteran in school of Computer Science or school of Mechanical Engineering
16. Find the young employees in school of Computer Science or school of Electrical Engineering in the rank of “Assistant Professor”
17. Construct ERD for a car-insurance company whose customers own one or more cars each. Each car has associated with it zero to any number of recorded accidents.
18. Construct an ERD for a hospital with a set of patients and a set of medical doctors. Associate with each patient a log of the various tests and examinations conducted.