Understanding SQL Subqueries by Example

Subqueries

Chapter 6

Objectives

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

- **Describe the types of problems that subqueries can solve**
- **Define subqueries**
- **List the types of subqueries**
- **Write single-row and multiple-row subqueries**

Using a Subquery to Solve a Problem

"Who has a salary greater than Jones'?"

"Which employees have a salary greater than Jones' salary?"

"What is Jones' salary?"

Subqueries

```
SELECT   select_list
FROM     table
WHERE    expr operator
                    (SELECT    select_List
                     FROM      table );
```

•The subquery (inner query) executes once before the main query.

•The result of the subquery is used by the main query (outerquery).

A subquery is a SELECT statement that is embedded in a clause of another SELECT statement. You can build powerful statements out of simple ones by using subqueries. They can be very useful when you need to select rows from a table with a condition that depends on the data in the table itself.

You can place the subquery in a number of SQL clauses

•WHERE clauss
•HAVING clause
•FROM clause
ln the syntax;

operator includes a comparison operatör such as >, =, or IN

Note: Comparison operutors fall iıto two classes: single-row operators

(> , = , >= , < , < > , <=)

and multiple-row operators (IN , ANY , ALL).

Using a Subquery

```
SELECT ename
FROM EMP
WHERE  sal  >
            ( SELECT sal
              FROM emp
              WHERE empno=7566);
```

ENAME
FORD
SCOTT
KING
FORD

Using a Subquery

```
SELECT ename, sal, deptno, job
FROM EMP
WHERE job =
            ( SELECT job
              FROM emp
              WHERE empno=7369);
```

ENAME	SAL	DEPTNO	JOB
ADAMS	1100	20	CLERK
JAMES	950	30	CLERK
MILLER	1300	10	CLERK
SMITH	800	20	CLERK
ADAMS	1100	20	CLERK
JAMES	950	30	CLERK
MILLER	1300	10	CLERK

7 rows selected.

```
SELECT ename, sal, deptno
  FROM EMP
  WHERE sal IN
                ( SELECT MIN(sal)
                  FROM emp
                 GROUP BY deptno );
```

ENAME	SAL	DEPTNO
JAMES	950	30
SMITH	800	20
MILLER	1300	10

```
SELECT empno, ename, job
FROM emp
WHERE sal < ANY
        ( SELECT sal
          FROM emp
          WHERE job = 'CLERK' );
```

EMPNO	ENAME	JOB
7369	SMITH	CLERK
7900	JAMES	CLERK
7876	ADAMS	CLERK
7521	WARD	SALESMAN
7654	MARTIN	SALESMAN

```
SELECT empno, ename, job
FROM emp
WHERE sal < ANY
              ( SELECT sal
                FROM emp
                WHERE job = 'CLERK' )
AND job <> 'CLERK' ;
```

EMPNO	ENAME	JOB
7521	WARD	SALESMAN
7654	MARTIN	SALESMAN

```
SELECT empno, ename, job
FROM emp
WHERE sal > ALL
              ( SELECT sal
                FROM emp
                WHERE job = 'CLERK' )
AND job <> 'CLERK' ;
```

EMPNO	ENAME	JOB
7499	ALLEN	SALESMAN
7566	JONES	MANAGER
7698	BLAKE	MANAGER
7782	CLARK	MANAGER
7788	SCOTT	ANALYST
7839	KING	PRESIDENT
7844	TURNER	SALESMAN
7902	FORD	ANALYST

8 rows selected.

```
SELECT empno, ename, job
  FROM emp
  WHERE sal > ALL
                ( SELECT AVG(sal)
                  FROM emp
                 GROUP BY deptno ) ;
```

EMPNO	ENAME	JOB
7566	JONES	MANAGER
7788	SCOTT	ANALYST
7839	KING	PRESIDENT
7902	FORD	ANALYST

Guidelines for Using Subqueries

- Enclose subqueries in parentheses.
- Place subqueries on the right side of the comparison operator.
- Do not add an ORDER BY clause to a subquery.
- Use single-row operators with single-row subqueries.
- Use multiple-row operators with multiple-row subqueries.

Types of Subqueries

- **Single-row subquery**
- **Multiple-row subquery**
- **Multiple-column subquery**

Types of Subqueries

Single-row subgueries:	Queries that return only one row from the inner SELECT stntenıent
Muliple-row subqueries:	QUERIES that return more than one rows from the inner SELECT statement
Muliple-column subqueries:	QUERIES that return more than one column from the inner SELECT statement.

Single-Row Subqueries

- **Return only one row**
- **Use single-row comparison operators**

Operator	Meaning
=	Equal to
>	Greater than
>=	Greater than or equal to
<	Less than
<=	Less than or equal to
<> , =!	Not equal to

```
SELECT ename, job
FROM EMP
WHERE job =
                ( SELECT job
                  FROM emp
                  WHERE empno=7369 ) ;
```

ENAME	JOB
ADAMS	CLERK
JAMES	CLERK
MILLER	CLERK
SMITH	CLERK
ADAMS	CLERK
JAMES	CLERK
MILLER	CLERK

7 rows selected.

Executing Single-Row Subqueries

Using Group Functions in a Subquery

```
SELECT ename, sal, deptno
FROM EMP
WHERE sal IN
        ( SELECT MIN(sal)
          FROM emp
          GROUP BY deptno ) ;
```

ENAME	SAL	DEPTNO
SMITH	800	20
JAMES	950	30
MILLER	1300	10

HAVING Clause with Subqueries

- **The Oracle Server executes subqueries first.**
- **The Oracle Server returns results into the HAVING clause of the main query.**

```
SELECT  job, AVG(sal)
  FROM emp
  GROUP BY  job
  HAVING   AVG(sal) =
                        ( SELECT MIN(AVG(sal))
                          FROM emp
                          GROUP BY job );
```

JOB	AVG(SAL)
CLERK	1037,5

What Is Wrong With This Statement?

```
SELECT      empno, ename
 FROM       emp
 WHERE      sal   =
           (SELECT       MIN(sal)
            FROM emp
            GROUP BY     deptno);
```

```
                        (SELECT         MIN(sal)
                         *
```

```
ERROR at line 4:
ORA-01427: single-row subquery returns more than one row
```

Will This Statement Work?

```
SELECT   ename,   job
    FROM        emp
    WHERE     job   =
                          ( SELECT  job
                            FROM        emp
                            WHERE      ename = 'SMYTHE' ) ;
```

no rows selected

Multiple-Row Subqueries

- **Return more than one row**
- **Use multiple-row comparison operators**

Operator	Meaning
IN	Equal to any member in the list
ANY	Compare value to each value returned by the subquery
ALL	Compare value to every value returned by the subquery

```
SELECT      ename, sal, deptno
  FROM      emp
  WHERE     sal IN    (SELECT    MIN(sal)
                       FROM     emp
                       GROUP BY deptno);
```

ENAME	SAL	DEPTNO
SMITH	800	20
JAMES	950	30
MILLER	1300	10

Using ANY Operator in Multiple-Row Subqueries

```
SELECT  ename, sal, job
  FROM emp
  WHERE sal <  ANY
                        ( SELECT sal
                          FROM emp
                          WHERE job = 'CLERK'  )
                          AND
                          job <> 'CLERK' ;
```

ENAME	SAL	JOB
WARD	1250	SALESMAN
MARTIN	1250	SALESMAN

Using ALL Operator in Multiple-Row Subqueries

```
SELECT  ename, sal, job
  FROM emp
  WHERE sal >  ALL
                        ( SELECT   AVG(sal)
                          FROM emp
                          GROUP BY deptno );
```

ENAME	SAL	JOB
JONES	2975	MANAGER
SCOTT	3000	ANALYST
KING	5000	PRESIDENT
FORD	3000	ANALYST

Summary

Subqueries are useful when a query is based on unknown values.

```
SELECT        select_list
FROM   table
WHERE  expr
                (SELEECT   select_list
                 FROM  table
                WHERE expr );
```

Practice Overview

Creating subqueries to query values based on unknown criteria

Using subqueries to find out what values exist in one set of data and not in another

1. Write a query to display the employee name and hiredate for all employees in the same department as Blake. Exclude Blake.

```
SELECT ename, hiredate
   FROM emp
   WHERE deptno =
                          ( SELECT deptno
                            FROM emp
                            WHERE ename = 'BLAKE')
   AND  ename <> 'BLAKE';
```

2. Create a query to display the employee number and name for all employees who earn more than the average salary. Sort the results in descending order of salary.

```
SELECT empno, ename
   FROM emp
   WHERE sal >
                          ( SELECT AVG(sal)
                            FROM emp );
```

3. Write a query to display the employee number and name for all employees who work in a department with any employee whose name contains a T. Save your SQL statemant in a file called p6q3.sql .

```
SELECT empno, ename
   FROM emp
   WHERE deptno IN
              ( SELECT deptno
                FROM emp
                WHERE ename LIKE  '%T%' );
```

4. Display the employee name, department number, and job title for all employees whose department location is Dallas.

   Solution with subquery:

```
SELECT ename, empno, job
   FROM emp
   WHERE deptno =  (SELECT deptno
                    FROM dept
                    WHERE loc ='DALLAS') ;
```

   Solution with equijoin:

```
SELECT ename, empno, job
   FROM emp e, dept d
   WHERE e.deptno =  d.deptno
   AND d.loc='DALLAS';
```

ENAME	EMPNO	JOB
SMITH	7369	CLERK
JONES	7566	MANAGER
SCOTT	7788	ANALYST
ADAMS	7876	CLERK
FORD	7902	ANALYST

5. Display the employee name and salary of all employees who report to King.

   Solution with self join:

```
SELECT e.ename, e.sal
   FROM emp e , emp d
   WHERE e.mgr = d.empno
   AND
   d.ename ='KING';
```

   Solution with subquery:

```
SELECT ename, sal
   FROM emp
   WHERE mgr = (SELECT  empno
                FROM emp
                WHERE ename = 'KING' );
```

6. Display the department number, name,, and job for all employees in the Sales department.

```
SELECT e.deptno, e.ename, e.job , d.dname
   FROM emp e , dept d
   WHERE e.deptno = d.deptno
   AND
   d.dname = 'SALES'
```

If yo u have time, complete the following exercises:

7. Modify *p6q3.sql* to display the employee number, name, and salary for all employees who earn more than the average salary and who work in a department with any employee with a T in their name. Rerun your query.

```
SELECT empno, ename , sal
   FROM emp
   WHERE sal >  (SELECT AVG (sal)
                 FROM emp )
AND
   deptno IN       ( SELECT deptno
                FROM emp
                WHERE ename LIKE '%T%');
```

EMPNO	ENAME	SAL
7902	FORD	3000
7788	SCOTT	3000
7566	JONES	2975
7698	BLAKE	2850

Exists

In the previous section, we used **IN** to link the inner query and the outer query in a subquery statement. **IN** is not the only way to do so -- one can use many operators such as >, <, or =. **EXISTS** is a special operator that we will discuss in this section.

EXISTS simply tests whether the inner query returns any row. If it does, then the outer query proceeds. If not, the outer query does not execute, and the entire SQL statement returns nothing.

The syntax for **EXISTS** is:

```
SELECT "column_name1"
FROM "table_name1"
WHERE EXISTS
                    ( SELECT *
                      FROM "table_name2"
                      WHERE [Condition] )
```

```
SELECT ename, deptno
FROM emp
WHERE EXISTS
                (SELECT *
                FROM emp
                WHERE sal >3500 )
```

ENAME	DEPTNO
SMITH	20
ALLEN	30
WARD	30
JONES	20
MARTIN	30
BLAKE	30
CLARK	10
SCOTT	20
KING	10
TURNER	30
ADAMS	20
JAMES	30
FORD	20
MILLER	10

14 rows returned in 0,01 seconds

```
SELECT ename, deptno
FROM emp
WHERE EXISTS
                (SELECT *
                FROM emp
                WHERE sal >3500 )
```

no data found

WHERE clause

Most often, the subquery will be found in the WHERE clause. These subqueries are also called **nested subqueries**.

```
select *
from all_tables tabs
where tabs.table_name in
                        (select cols.table_name
                         from all_tab_columns cols
                         where cols.column_name = 'ENAME');
```

Limitations:

Oracle allows up to 255 levels of subqueries in the WHERE clause.

FROM clause

A subquery can also be found in the FROM clause. These are called **inline views**.

For example:

```
select dept.deptno, subquery1.total_amt
from dept,
     ( select emp.deptno, Sum(emp.sal) total_amt
       from emp
       group by deptno) subquery1
WHERE subquery1.deptno = dept.deptno
```

DEPTNO	TOTAL_AMT
30	9400
10	8750
20	10875

```
3 rows returned in 0,02 seconds
```

In this example, we've created a subquery in the FROM clause as follows:

```
     ( select emp.deptno, Sum(emp.sal) total_amt
       from emp
       group by deptno) subquery1
```

This subquery has been aliased with the name *subquery1*. This will be the name used to reference this subquery or any of its fields.

Limitations:

Oracle allows an unlimited number of subqueries in the FROM clause.

SELECT clause

A subquery can also be found in the SELECT clause.

For example:

```
select tbls.owner, tbls.table_name,
  (select count(column_name) as total_columns
   from all_tab_columns cols
   where cols.owner = tbls.owner
   and cols.table_name = tbls.table_name) subquery2
from all_tables tbls;
```

OWNER	TABLE_NAME	SUBQUERY2
SYS	DUAL	1
SYS	SYSTEM_PRIVILEGE_MAP	3
SYS	TABLE_PRIVILEGE_MAP	2
SYS	STMT_AUDIT_OPTION_MAP	3
SYS	AUDIT_ACTIONS	2
SYSTEM	DEF$_TEMP$LOB	3
SYSTEM	HELP	3
CTXSYS	DR$OBJECT_ATTRIBUTE	14
CTXSYS	DR$POLICY_TAB	2
CTXSYS	DR$NUMBER_SEQUENCE	1
MDSYS	OGIS_SPATIAL_REFERENCE_SYSTEMS	5
MDSYS	OGIS_GEOMETRY_COLUMNS	10
MDSYS	SDO_UNITS_OF_MEASURE	12
MDSYS	SDO_PRIME_MERIDIANS	6
MDSYS	SDO_ELLIPSOIDS	10

More than 15 rows available. Increase rows selector to view more rows.

15 rows returned in 0,15 seconds CSV Export

In this example, we've created a subquery in the SELECT clause as follows:

```
(select count(column_name) as total_columns
 from all_tab_columns cols
 where cols.owner = tbls.owner
 and cols.table_name = tbls.table_name) subquery2
```

The subquery has been aliased with the name *subquery2*. This will be the name used to reference this subquery or any of its fields.

The trick to placing a subquery in the select clause is that the subquery must return a single value. This is why an aggregate function such as SUM, COUNT, MIN, or MAX is commonly used in the subquery.

Stepping through Sub-Queries in Oracle

(Page 1 of 5)

This is the first article in a series concentrating on working with sub-queries in Oracle. Sub-queries really have tremendous depth. In this series I will show you several scenarios where they can be efficiently used to retrieve information from Oracle databases.

As this is the first in series, I will be concentrating on the following topics:

- How to work with a “dual” table.
- How to analyze and identify the steps needed to deal with a sub-query.
- How to frame queries for each of the identified steps.
- How to combine all the framed queries and design a single command to retrieve the final output.

A primer on the “dual” table in Oracle

This section mainly explains the “dual” table in Oracle. I shall use this table in a creative manner wherever required in this article as well as upcoming articles. If you are already familiar with the "dual” table, feel free to skip to the next section.

What is a “dual” table? It is a simple table which is created/installed automatically during the installation of the Oracle database. To understand it, let us consider the following SELECT statement:

```
SELECT 123 FROM dual;
```

The above statement simply returns 123. Let us work with another statement:

```
SQL> SELECT 10,20,’Veri Tabanı Yönetim Sistemleri’,3400 FROM
dual;

Results   Explain   Describe  Saved SQL History
```

10	20	'VERITABANI YÖNETIMSISTEMLERI'	3400
10	20	Veri Tabanı Yönetim Sistemleri	3400

```
1 rows returned in 0,00 seconds                CSV Export
```

This returns any constant values you provide as columns. So “dual” is just a convenience table. It is simply a one column and one row table that exists as part of SYS user. You can use the DESC command to display the structure of a “dual” table as follows:

```
DESC dual;
```

The above statement returns the following output:

ResultsExplain Describe Saved SQL History

Table	Column	Data Type	Length	Precision	Scale	Primary Key	Nullable	Default	Comment
DUAL	DUMMY	Varchar2	1	-	-	-		-	-

You can observe that there exists only one column named “dummy” in the "dual" table. Similarly, you can even display all the rows in the "dual" table as follows:

```
SELECT * FROM dual;
```

```
DUMMY

-----

X

1 rows selected
```

From the above, you can observe that there exists only one row with a dummy value of "x."

You don't really need to use the “dual” table at all. It is only used when you want to add/include any constant values in your queries. You can even do calculations as follows:

```
SQL> SELECT 12 * 13 + 14 FROM dual;

12*13+14

----------------------

170

1 rows selected
```

Stepping through Sub-Queries in Oracle - The simplest sub-query in Oracle

Before explaining sub-queries, let us consider the following scenario:

```
SQL> SELECT empno,ename,sal,deptno FROM emp

WHERE sal = 5000;

EMPNO     ENAME      SAL          DEPTNO

--------- ---------- ----------- ------------

7839      KING       5000        10

1 rows selected
```

Let us modify the above statement as follows:

```
SQL> SELECT empno,ename,sal,deptno FROM emp

WHERE sal = (SELECT 5000 FROM dual);
```

I already explained the "dual" table in the previous section. In the above statement, I have two SELECT statements as part of a single command. The following is the order in which the above statement gets executed:

- The innermost query gets executed first.
- In this case, the query "select 5000 from dual" gets executed first.
- Once the innermost query gets executed, it returns a value to the immediate outer query. In this case, it is 5000.
- The entire innermost query gets replaced with the new value returned by it. In this case, the outer query virtually becomes "select empno, ename, sal, deptno from emp where sal = 5000."
- And finally, the outer query gets executed, which retrieves KING's details.

In the above case, I used a SELECT query as part of another SELECT query; thus it is called a "sub-query." You can even modify the above statement to include an expression as follows:

```
SQL> SELECT empno,ename,sal,deptno FROM emp

WHERE sal = (SELECT 2000+3000 FROM dual);
```

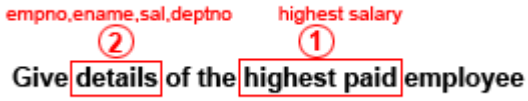
The above statement first evaluates "2000+3000" (which results in 5000) as part of executing the inner query. Based on the returned value (which is 5000), the outer query gets executed.

The next section will show you a few simple and practically used sub-queries.

Stepping through Sub-Queries in Oracle - A sub-query with aggregate functions (or group functions) in Oracle
(Page 3 of 5)

I already introduced sub-queries in the previous section. In this section, I shall start giving you some practical examples.

Let us consider that I would like to retrieve the details of the highest paid employee. Let us write the question in a meaningful manner and identify the steps as follows:



From the above figure, you have two steps to work with for the query. The following is the order you must follow (based on the above figure):

- Find the highest salary from the table (1)
- Based on the value you get, retrieve the employee details like empno, ename, etc. belonging to that salary. (2)

The following is the statement which retrieves the highest salary:

```
SELECT MAX(sal) FROM emp
```

To retrieve an employee's details based on a given salary (say 5000), the query would be as follows:

```
SELECT empno,ename,sal,deptno FROM emp

WHERE sal = 5000
```

Just replace the value 5000 with the query that gives you the highest salary. The complete statement would be as follows:

```
SQL> SELECT empno,ename,sal,deptno FROM emp

WHERE sal = (SELECT MAX(sal) FROM emp);
```

Now, let us walk through its execution:

- The innermost query gets executed first.
- In this case, the query “select max(sal) from emp” gets executed first. It retrieves the highest value in the column “sal” from the table “emp.”
- Once the innermost query gets executed, it returns a value to the immediate outer query. In this case, it is 5000.
- The entire innermost query gets replaced with the new value returned by it. In this case, the outer query virtually becomes “select empno, ename, sal, deptno from emp where sal = 5000.”

- And finally, the outer query gets executed, which retrieves KING's details.

Let us end this section with a final touch. Why can't I write the above query as follows?

```
SQL> SELECT empno,ename,sal,deptno FROM emp

WHERE sal = MAX(sal)
```

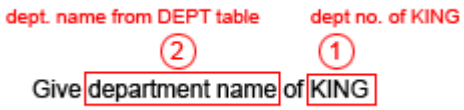
Or even the following:

```
SQL> SELECT empno,ename,sal,deptno FROM emp

WHERE MAX(sal) = sal
```

None of the above two queries get executed successfully. The reason is that a condition in a WHERE clause cannot contain any aggregate function (or group function) without a sub-query!

Stepping through Sub-Queries in Oracle - Designing sub-queries to deal with more than one table (or different tables)
(Page 4 of 5)

Let us consider that I would like to retrieve KING's department name. All department names are available in the table "dept," which is quite different from "emp" table. Let us write the question in a meaningful manner and identify the steps as follows:



From the above figure, you have two steps to go through with the query. The following is the order you must follow (based on the above figure):

- Find KING's department number (1).
- Based on the value you get, retrieve the department details like dname, loc. etc belonging to that department number (2)

The following is the statement which retrieves KING's department number:

```
SELECT deptno FROM emp WHERE ename = 'KING'
```

To retrieve department details based on a given department number (say 30), the query would be as follows:

```
SELECT dname FROM dept

WHERE deptno = 30
```

Just replace the value 30 with the query that gives you KING's department number. The complete statement would be as follows:

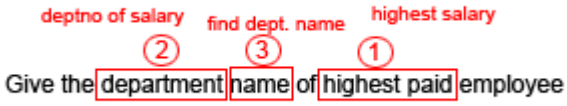
```
SQL> SELECT dname FROM dept

WHERE deptno = (SELECT deptno FROM emp WHERE ename='KING');
```

Now, let us walk through its execution:

- The innermost query gets executed first.
- In this case, the query "select deptno from emp where ename='king'" gets executed first. It retrieves KING's department number.
- Once the innermost query gets executed, it returns a value to the immediate outer query. In this case, it is 10.
- The entire innermost query gets replaced with the new value returned by it. In this case, the outer-query virtually becomes "select dname from dept where deptno = 10."
- And finally, the outer query gets executed, which retrieves KING's department details

Stepping through Sub-Queries in Oracle - An example of a nested sub-query (or multi-level sub-query)

Let us consider that I would like to retrieve the department name of the highest paid employee. Let us write the question in a meaningful manner and identify the steps as follows:



From the above figure, you have three steps to go through with the query. The following is the order you must follow (based on the above figure):

- Find the highest salary (1).
- Based on the value you get, retrieve the department number belonging to that salary (2).
- Based on the value you get, find the department name belonging to that department number (3).

The following is the statement which finds the highest salary:

```
SELECT MAX(sal) FROM emp
```

To retrieve a department number based on a given salary (say 2000), the query would be as follows:

```
SELECT deptno FROM emp

WHERE sal = 2000
```

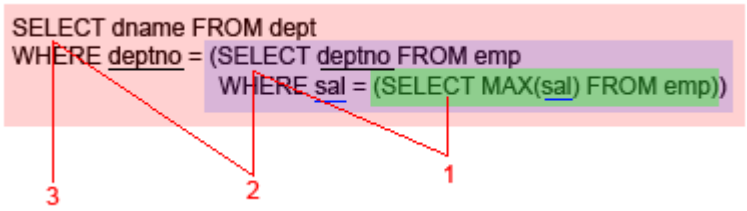
To retrieve a department name based on a given department number (say 20), the query would be as follows:

```
SELECT dname FROM dept

WHERE deptno = 20
```

Combining all of the above queries according to the order given above, the new query would be as follows:

```
SQL> SELECT dname FROM dept

WHERE deptno = (SELECT deptno FROM emp

                WHERE sal = (SELECT MAX(sal) FROM EMP));
```

You can observe the following figure to understand how the execution takes place. You can also observe the underlined columns on how they relate logically:



Now, let us walk through its execution:

- The innermost query gets executed first.
- In this case, the query "select max(sal) from emp" gets executed first. It retrieves the highest salary. In this case it would be 5000.
- The entire innermost query gets replaced with the new value returned by it. In this case, the immediate outer query virtually becomes "select deptno from emp where sal = 5000." Once this query gets executed, it returns a department number, which is 10 in this case.
- And finally, the outermost query virtually becomes "select dname from dept where deptno = 10," which retrieves KING's department details.

Any bugs, doubts, suggestions, feedback etc. are highly appreciated at
http://jagchat.spaces.live.com

Sub-Queries with multiple columns in Oracle

Let us try to work with the following query:

```
SELECT
*
FROM emp
WHERE (sal,mgr) = (3000,7566)
```

ORA-00920: invalid relational operator

The above would never work and results in giving you the "invalid relational operator" error. This is because you can compare only one value at a time and not more than one. The following is a small trick to overcome the problem:

```
SELECT
*
FROM emp
WHERE (sal,mgr) = (SELECT 3000,7566 FROM dual)
```

EMPNO	ENAME	JOB	MGR	HIREDATE	SAL	COMM	DEPTNO
7788	SCOTT	ANALYST	7566	09/12/1982	3000	-	20
7902	FORD	ANALYST	7566	03/12/1981	3000	-	20

2 rows returned in 0,00 seconds CSV Export

I just made both of those two values part of the sub-query and it works fine! Both of those values are not from any table, so I used "dual." Now you can observe the power of the "dual" table. If you want to learn more about "dual," please refer to my first article in this series.

Let us work with a more practical sub-query rather than with a "dual" table as follows:

```
SELECT
*
FROM emp
WHERE (sal,mgr) =
(SELECT sal,mgr FROM emp
             WHERE sal = (SELECT MIN(sal) FROM EMP
                          WHERE sal > (SELECT MIN(sal) FROM
emp)))
```

EMPNO	ENAME	JOB	MGR	HIREDATE	SAL	COMM	DEPTNO
7900	JAMES	CLERK	7698	03/12/1981	950	-	30

1 rows returned in 0,00 seconds CSV Export

The above returns all the employees who are earning the same salary and working under the same manager of the employee earning the second least salary!

Inserting Sub-Queries in SELECT Statements in Oracle - Sub-Queries returning single and multiple values in Oracle

Let us consider the following statement:

```
SELECT
*
FROM emp
WHERE sal = 800
```

When you execute the above statement, the condition in the WHERE clause works with only a single value. Let us rewrite the above statement with a plain sub-query as follows:

```
SELECT
*
FROM emp
WHERE sal = (SELECT MIN(sal) FROM emp)
```

From the above statement you can understand that the sub-query returns one and only one value (or single value) and the query works fine.

If we would like to work with more than one value in a condition (of equality), you may need to work something like the following:

```
SELECT
*
FROM emp
WHERE empno IN (7902,7788)
```

Let us frame the above with a sub-query as follows:

```
SELECT

*

FROM emp

WHERE empno IN

    (SELECT empno FROM emp

       WHERE sal = (SELECT MAX(sal) FROM EMP
```

```
                    WHERE sal < (SELECT
MAX(sal) FROM emp)))
```

EMPNO	ENAME	JOB	MGR	HIREDATE	SAL	COMM	DEPTNO
7788	SCOTT	ANALYST	7566	09/12/1982	3000	-	20
7902	FORD	ANALYST	7566	03/12/1981	3000	-	20

2 rows returned in 0,03 seconds CSV Export

The above query gives us all the employees earning the second highest salary! In the above case, the second level sub-query returns more than one value (or two employee numbers). Therefore, I provided the IN operator as part of the condition. If you replace the IN with "=" in the above query, it will return with an error stating "single row sub-query returns more than one row." When you receive such an error, try to replace "=" with "IN" wherever appropriate.

Inserting Sub-Queries in SELECT Statements in Oracle - Sub-Queries as part of the BETWEEN operator in Oracle

BETWEEN is a unique operator in Oracle. Let me show you a small example of this:

```
SELECT
*
FROM emp
WHERE sal BETWEEN 1000 and 3000
```

It is very easy to understand the above query as it returns all the employees who earn salaries between 1000 and 3000 (both inclusive). Let us rewrite the above query as follows:

```
SELECT
*
FROM emp
WHERE sal BETWEEN
(SELECT 1000 FROM dual) AND 3000
```

I just replaced 1000 with a simple sub-query using "dual." If you are new to the "dual" table, please refer to my first article in this series. Let us work a bit more practically as follows:

```
SELECT
*
FROM emp
WHERE sal BETWEEN
    (SELECT MIN(sal) FROM emp) and 2000
```

We can even work a bit differently. Let us go through the following query:

```
SELECT
Grade
FROM salgrade
WHERE
    (SELECT MAX(sal) FROM emp)
    BETWEEN losal AND hisal
```

The above gives you the salary grade of the highest salary!

Inserting Sub-Queries in SELECT Statements in Oracle - Derived tables (or inline views) with Sub-Queries in Oracle

Can we write sub-queries in (or as part of) the FROM clause? The answer is YES and you can use it very efficiently in some scenarios.

Let us consider the following statement:

```
SELECT empno,ename,sal,sal*12 AS AnnSal
FROM emp
WHERE AnnSal > 30000
```

If I execute the above statement, it will result in an error saying that "AnnSal" is an "Invalid Identifier." The reason is that "AnnSal" is not a column existing in the table "emp." It is simply an alias (or some reasonable name). We are not allowed to work with a column alias in any of the conditions present in WHERE clause.

Let us modify the above statement to make it work. Try the following now:

```
SELECT empno,ename,sal,AnnSal
FROM (
      SELECT empno,ename,sal,sal*12 AS AnnSal
      FROM emp
      )
WHERE AnnSal > 30000
```

The above statement is totally different from the previous one. Within the above statement, the outer query doesn't rely on any specific physical table. The output (or result set) of the inner query is considered as a table for the outer query! The inner query is very similar to that of a view which doesn't have any physical view name, and it gets created and destroyed on the fly.

So, according to the inner query, it retrieves four columns (empno, ename, sal, AnnSal). The outer query can work with all four columns as if they are directly from a physical table.

As you are trying to define/derive your own table of information from an existing physical table, you call it as a derived table (or inline view). Even the derived tables can be nested to any number of levels with further sub-derived tables as part of FROM clauses.

Inserting Sub-Queries in SELECT Statements in Oracle - Sub-Queries with CASE structure in Oracle SELECT statements

Now let us go through an interesting topic on CASE structure. Let us see how a CASE structure works. Consider the following statement:

```
SELECT
  empno,
  ename,
  CASE job
    WHEN 'SALESMAN' THEN 'SALES'
    WHEN 'MANAGER' THEN 'MGMT'
    ELSE job
  END AS jobfunction,
  sal
FROM emp
```

EMPNO	ENAME	JOBFUNCTION	SAL
7369	SMITH	CLERK	800
7499	ALLEN	SALES	1600
7521	WARD	SALES	1250
7566	JONES	MGMT	2975
7654	MARTIN	SALES	1250
7698	BLAKE	MGMT	2850
7782	CLARK	MGMT	2450
7788	SCOTT	ANALYST	3000
7839	KING	PRESIDENT	5000
7844	TURNER	SALES	1500
7876	ADAMS	CLERK	1100
7900	JAMES	CLERK	950
7902	FORD	ANALYST	3000
7934	MILLER	CLERK	1300

14 rows returned in 0,01 seconds CSV Export

When the above query is executed, it returns four columns (empno, ename, jobfunction, sal). The only eye-catching issue from the above is the following structure:

```
  CASE job
    WHEN 'SALESMAN' THEN 'SALES'
    WHEN 'MANAGER' THEN 'MGMT'
    ELSE job
  END AS jobfunction
```

The above dictates something very similar to the following:

- If the value of "job" is "salesman" return "sales."
- If the above condition fails and if the value of "job" is "manager" return "mgmt."
- If both of the above conditions fail then return the same value of "job."
- All the values must be returned in a new column with the heading "jobfunction."

You need to observe that I specified the column (job) along with CASE. The conditions of WHEN work with the values available within that column. We can even work with different relational (and SQL) operators within the WHEN condition as shown in the following example:

```
SELECT
  empno,
  ename,
  CASE
    WHEN comm IS NULL OR comm=0 THEN '-NA-'
    ELSE TO_CHAR(comm)
  END AS comm,
  sal
FROM emp
```

EMPNO	ENAME	COMM	SAL
7369	SMITH	-NA-	800
7499	ALLEN	300	1600
7521	WARD	500	1250
7566	JONES	-NA-	2975
7654	MARTIN	1400	1250
7698	BLAKE	-NA-	2850
7782	CLARK	-NA-	2450
7788	SCOTT	-NA-	3000
7839	KING	-NA-	5000
7844	TURNER	-NA-	1500
7876	ADAMS	-NA-	1100
7900	JAMES	-NA-	950
7902	FORD	-NA-	3000
7934	MILLER	-NA-	1300

14 rows returned in 0,01 seconds CSV Expor

In the above case, the conditions are directly used within the WHEN statement and you need not specify any column with the CASE.

Finally, you can even work with sub-queries within the CASE structure as follows:

```
SELECT
  empno,
  ename,
  CASE
    WHEN sal >= (SELECT avg(sal) FROM emp) THEN
'HIGH'
    ELSE 'LOW'
  END AS pay,
  sal
FROM emp
```

The above returns a new column named “pay,” which contains either “HIGH” or “LOW” based on their salary compared to the average salary of all employees.

Inserting Sub-Queries in SELECT Statements in Oracle - Sub-Queries as (or part of) columns in Oracle SELECT statements

Before getting into sub-queries as part of columns, let us look at the following small query:

```
SELECT
    MAX(sal) AS highest,
    MIN(sal) AS least,
    COUNT(*) AS employees,
    SUM(sal) AS total
FROM emp
```

Everyone can easily understand that the above query returns only one row containing four values of aggregation. Let us rewrite the above query using sub-queries to get the same output.

```
SELECT
  (SELECT MAX(sal) FROM emp) AS highest,
  (SELECT MIN(sal) FROM emp) AS least,
  (SELECT COUNT(*) FROM emp) AS employees,
  (SELECT SUM(sal) FROM emp) AS total
FROM dual
```

You can observe that I replaced all aggregate functions with sub-queries! Another important issue to concentrate on in the above query is the “dual” table. As the sub-queries in the above statement are working individually by themselves, I need not work with any table and thus I used the “dual” table. If you want to learn more about the “dual” table, please go through my first article in this same series.

Now, let us look at an interesting query which deals with sub-queries at both the column level and the CASE level. The following is the query:

```
SELECT
  empno,
  ename,
  sal AS salary,
  ROUND((sal -(SELECT AVG(sal) FROM emp)),2) AS
avgcompare,
  CASE
    WHEN sal >= (SELECT AVG(sal) FROM emp) THEN
'HIGH'
    ELSE 'LOW'
  END AS paying
FROM emp
```

The following is the sample output of the above query:

EMPNO	ENAME	SALARY	AVGCOMPARE	PAYING
7839	KING	5000	2926.79	HIGH
7698	BLAKE	2850	776.79	HIGH
.				
.				
7654	MARTIN	1250	-823.21	LOW
7499	ALLEN	1600	-473.21	LOW

Any bugs, doubts, suggestions, feedback etc. are highly appreciated at
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