Grouping by More Than One Column

EMP

DEPTNO	JOB	SAL
10	MANAGER	2450
10	PRESIDENT	5000
10	CLERK	1300
20	CLERK	800
20	CLERK	1100
20	ANALYST	3000
20	ANALYST	3000
20	MANAGER	2975
30	SALESMAN	1600
30	MANAGER	2850
30	SALESMAN	1250
30	CLERK	950
30	SALESMAN	1500
30	SALESMAN	1250

"sum salaries in the EMP table for each job, grouped by department"

DEPTNO	JOB	SUM(SAL)
10	CLERK	1300
10	MANAGER	2450
10	PRESIDENT	5000
20	ANALYST	6000
20	CLERK	1900
20	MANAGER	2975
30	CLERK	950
30	MANAGER	2850
30	SALESMAN	5600

Using the GROUP BY Clause on Multiple Columns

```
SQL> SELECT    deptno, job, sum(sal)
  2  FROM      emp
  3  GROUP BY deptno, job;
```

```
   DEPTNO JOB        SUM(SAL)
--------- --------- ---------
       10 CLERK          1300
       10 MANAGER        2450
       10 PRESIDENT      5000
       20 ANALYST        6000
       20 CLERK          1900
...
9 rows selected.
```

Illegal Queries Using Group Functions

- Any column or expression in the SELECT list that is not an aggregate function must be in the GROUP BY

```
SQL> SELECT   deptno, COUNT(ename)
  2  FROM emp;
```

Column missing in the GROUP BY clause

Excluding Group Results

EMP

```
   DEPTNO        SAL
--------- ----------
       10       2450
       10       5000
       10       1300
       20        800
       20       1100
       20       3000
       20       3000
       20       2975
       30       1600
       30       2850
       30       1250
       30        950
       30       1500
       30       1250
```

5000

3000

2850

"maximum salary per department greater than $2900"

```
   DEPTNO   MAX(SAL)
--------- ----------
       10       5000
       20       3000
```

Excluding Group Results: HAVING Clause

- Use the HAVING clause to restrict groups
  - Rows are grouped.
  - The group function is applied.
  - Groups matching the HAVING clause are displayed.

```
SELECT column, group_function
FROM        table
[WHERE condition]
[GROUP BY group_by_expression]
[HAVING    group_condition]
[ORDER BY column];
```

Using the HAVING Clause

```
SQL> SELECT    deptno, max(sal)
  2  FROM      emp
  3  GROUP BY deptno
  4  HAVING    max(sal)>2900;
```

```
   DEPTNO  MAX(SAL)
--------- ---------
       10      5000
       20      3000
```

Using the HAVING Clause

```
SQL> SELECT     job, SUM(sal) AS PAYROLL
  2  FROM       emp
  3  WHERE      job NOT LIKE 'SALES%'
  4  GROUP BY   job
  5  HAVING     SUM(sal)>5000
  6  ORDER BY   SUM(sal);
```

```
JOB          PAYROLL
--------- ---------
ANALYST         6000
MANAGER         8275
```

Summary of aggregating data

```
SELECT column, group_function(column)
FROM      table
[WHERE condition]
[GROUP BY group_by_expression]
[HAVING   group_condition]
[ORDER BY column];
```

- Order of evaluation of the clauses:
  - WHERE clause
  - GROUP BY clause
  - HAVING clause

SUBQUERIES

Using a Subquery to Solve a Problem

- "Who has a salary greater than Jones'?"

Main Query

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

Subquery

"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 (outer query).

Using a Subquery

```
SQL> SELECT ename
  2  FROM   emp        2975
  3  WHERE  sal >
  4        (SELECT sal
  5         FROM   emp
  6         WHERE  empno=7566);
```

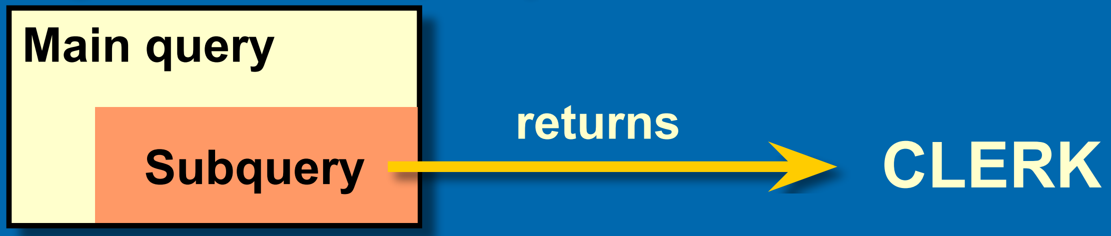
```
ENAME
----------
KING
FORD
SCOTT
```

Guidelines for Using Subqueries

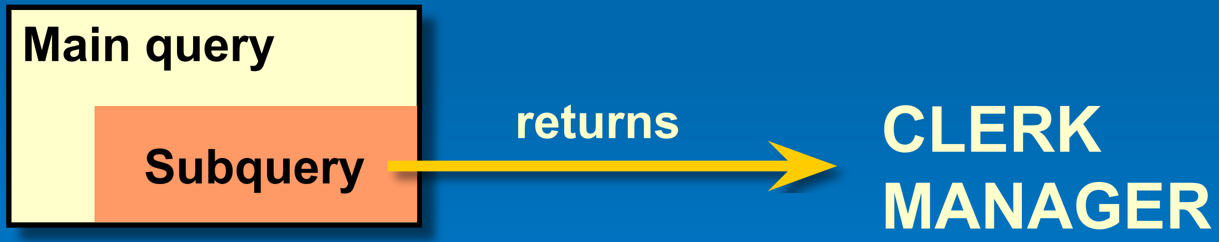
- Enclose subqueries in parentheses.
- Place subqueries on the right side of the comparison operator.
- Use single-row operators with single-row subqueries.
- Use multiple-row operators with multiple-row subqueries.

Types of Subqueries

- Single-row subquery



- Multiple-row subquery



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

Executing Single-Row Subqueries

```
SQL> SELECT    ename, job
  2  FROM      emp
  3  WHERE     job =
  4    (SELECT    job
  5        FROM      emp
  6        WHERE     empno = 7369)
  7  AND       sal >
  8    (SELECT    sal
  9     FROM    emp
 10        WHERE   empno = 7876);
```

CLERK

1100

```
ENAME      JOB
---------- ---------
MILLER     CLERK
```

Using Group Functions in a Subquery

```
SQL> SELECT   ename, job, sal
  2  FROM emp
  3  WHERE     sal =
  4          (SELECT    MIN(sal)
  5          FROM       emp);
```

800

```
ENAME       JOB                  SAL
---------- --------- ----------
SMITH       CLERK                800
```

HAVING Clause with Subqueries

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

```
SQL> SELECT   deptno, MIN(sal)
  2  FROM emp
  3  GROUP BY deptno                          800
  4  HAVING   MIN(sal) >
  5    (SELECT    MIN(sal)
  6     FROM    emp
  7     WHERE   deptno = 20);
```

What Is Wrong with This Statement?

```
SQL> SELECT empno, ename
  2  FROM   emp
  3  WHERE  sal =
  4    (SELECT   MIN(sal)
  5     FROM     emp
  6     GROUP BY deptno);
```

Single-row operator with multiple-row subquery

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

no rows selected
```

Will This Statement Work?

```
SQL> SELECT ename, job
  2  FROM   emp
  3  WHERE  job =
  4     (SELECT    job
  5      FROM    emp
  6      WHERE   ename='SMYTHE');
```

```
no rows selected
```

Subquery returns no values

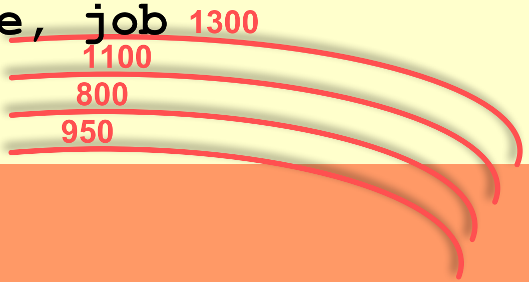
Multiple-Row Subqueries

- 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

Using ANY Operator in Multiple-Row Subqueries

```
SQL> SELECT   empno, ename, job
  2  FROM     emp
  3  WHERE    sal < ANY
  4          (SELECT    sal
  5              FROM   emp
  6          WHERE  job = 'CLERK')
  7  AND          job <> 'CLERK';
```



```
     EMPNO ENAME      JOB
--------- ---------- ---------
      7654 MARTIN     SALESMAN
      7521 WARD       SALESMAN
```

Using ALL Operator in Multiple-Row Subqueries

```
SQL> SELECT   empno, ename, job
  2  FROM     emp
  3  WHERE    sal > ALL
  4      (SELECT   avg(sal)
  5               FROM      emp
  6          GROUP BY  deptno);
```

1566.6667
2175
2916.6667

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

Summary of Subqueries

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

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