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.
```

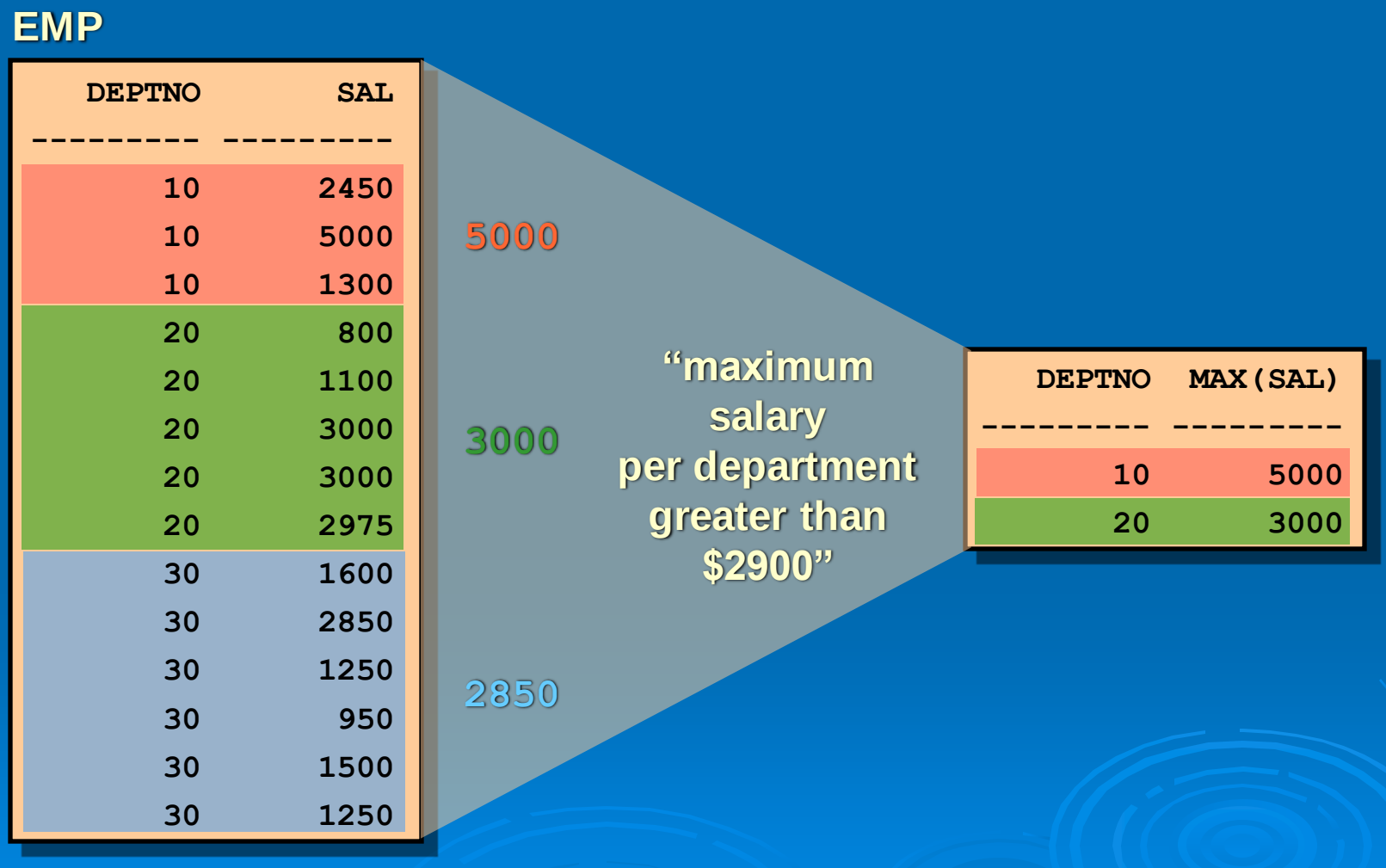
Illegal Queries Using Group Functions

- 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



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

2975

```
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);
```

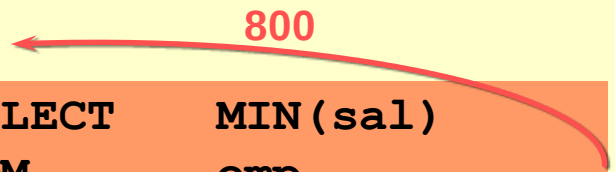
800

```
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
  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';
```

1300
1100
800
950

```
     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);
```