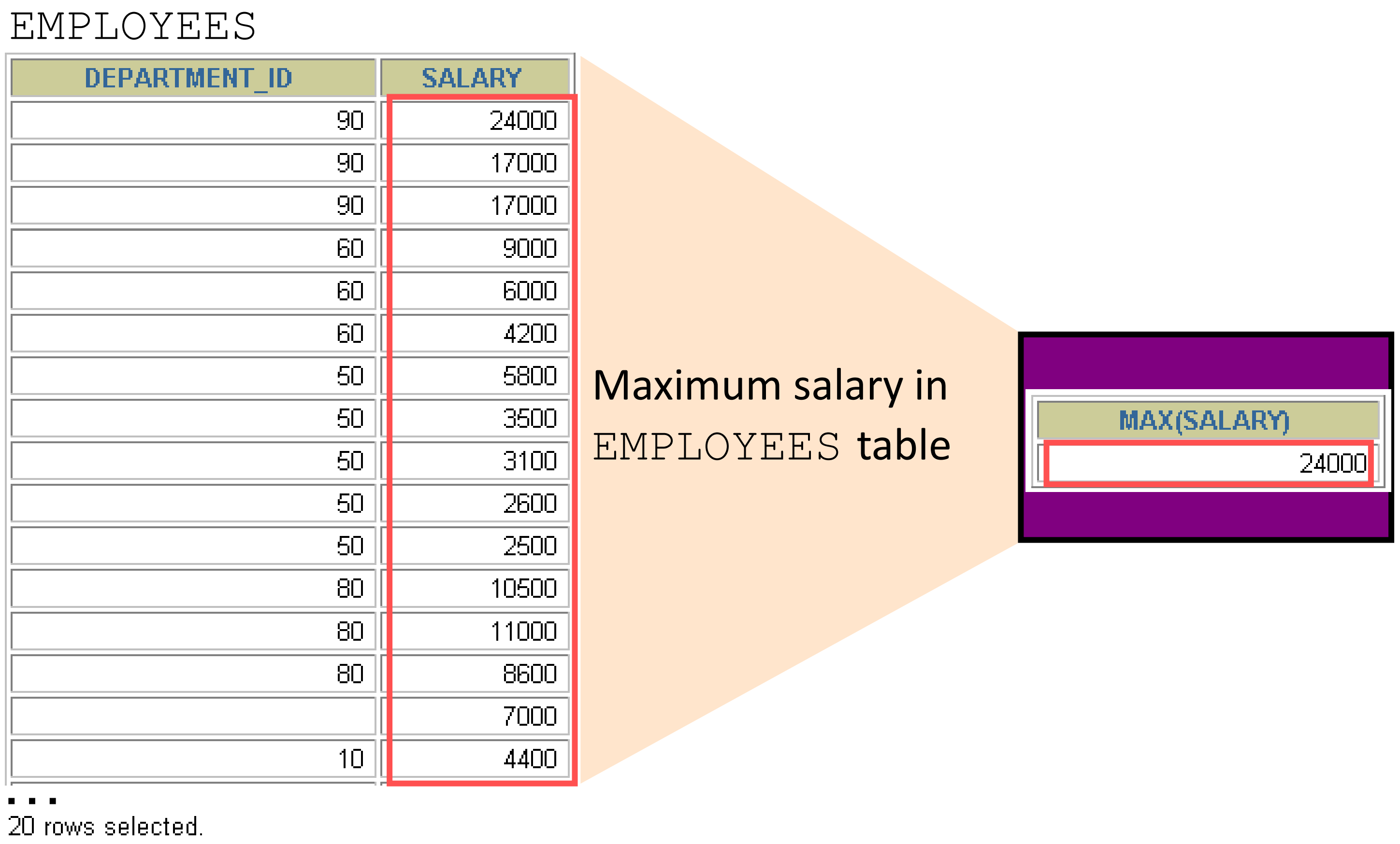
Reporting Aggregated Data Using the Group Functions

Objectives

- After completing this lesson, you should be able to do the following:
  - Identify the available group functions
  - Describe the use of group functions
  - Group data by using the `GROUP BY` clause
  - Include or exclude grouped rows by using the `HAVING` clause

What Are Group Functions?

- Group functions operate on sets of rows to give one result per group.


EMPLOYEES

DEPARTMENT_ID	SALARY
90	24000
90	17000
90	17000
60	9000
60	6000
60	4200
50	5800
50	3500
50	3100
50	2600
50	2500
80	10500
80	11000
80	8600
	7000
10	4400

...
20 rows selected.

Maximum salary in EMPLOYEES table

MAX(SALARY)
24000

Types of Group Functions

- `AVG`
- `COUNT`
- `MAX`
- `MIN`
- `STDDEV`
- `SUM`
- `VARIANCE`

Group Functions: Syntax

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

Using the AVG and SUM Functions

- You can use AVG and SUM for numeric data.

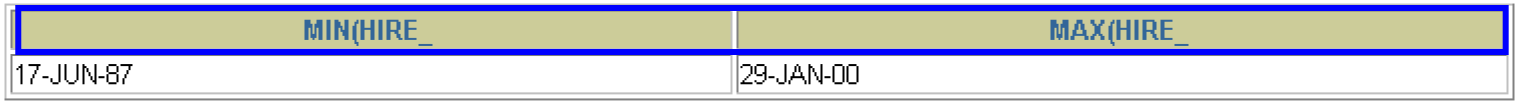
```
SELECT AVG(salary), MAX(salary),
       MIN(salary), SUM(salary)
FROM   employees
WHERE  job_id LIKE '%REP%';
```

AVG(SALARY)	MAX(SALARY)	MIN(SALARY)	SUM(SALARY)
8150	11000	6000	32600

Using the MIN and MAX Functions

- You can use MIN and MAX for numeric, character, and date data types.

```
SELECT MIN(hire_date), MAX(hire_date)
FROM       employees;
```



MIN(HIRE_	MAX(HIRE_
17-JUN-87	29-JAN-00

Using the `COUNT` Function

- `COUNT(*)` returns the number of rows in a table:

1

```
SELECT COUNT(*)
FROM   employees
WHERE  department_id = 50;
```

COUNT(*)
5

- `COUNT(`*`expr`*`)` returns the number of rows with non-null values for the *`expr`*:

2

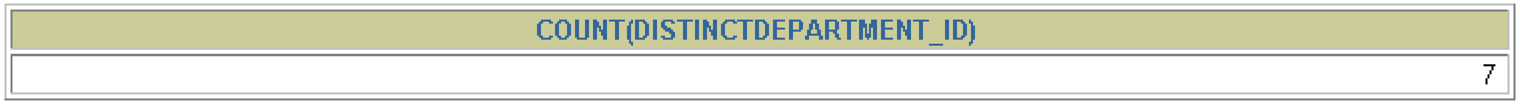
```
SELECT COUNT(commission_pct)
FROM   employees
WHERE  department_id = 80;
```

COUNT(COMMISSION_PCT)
3

Using the `DISTINCT` Keyword

- `COUNT(DISTINCT expr)` returns the number of distinct non-null values of the *`expr`*.
- To display the number of distinct department values in the `EMPLOYEES` table:

```
SELECT COUNT(DISTINCT department_id)
FROM   employees;
```



```
COUNT(DISTINCTDEPARTMENT_ID)
                           7
```

Group Functions and Null Values

- Group functions ignore null values in the column:

1

```
SELECT AVG(commission_pct)
FROM   employees;
```

```
AVG(COMMISSION_PCT)
              .2125
```

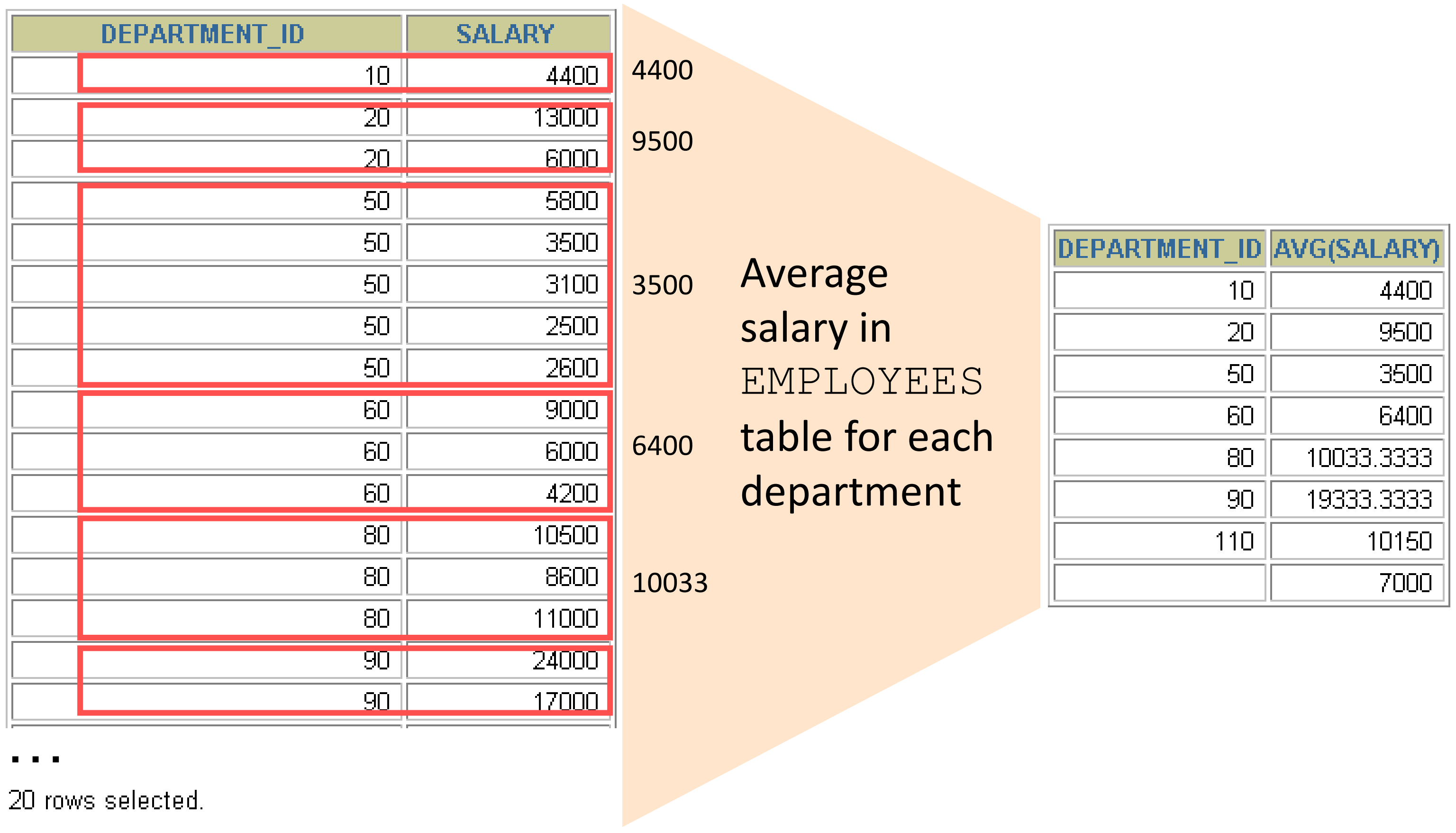
- The NVL function forces group functions to include null values:

2

```
SELECT AVG(NVL(commission_pct, 0))
FROM   employees;
```

```
AVG(NVL(COMMISSION_PCT,0))
                     .0425
```

Creating Groups of Data



EMPLOYEES

DEPARTMENT_ID	SALARY
10	4400
20	13000
20	6000
50	5800
50	3500
50	3100
50	2500
50	2600
60	9000
60	6000
60	4200
80	10500
80	8600
80	11000
90	24000
90	17000

...

20 rows selected.

Average salary in EMPLOYEES table for each department

DEPARTMENT_ID	AVG(SALARY)
10	4400
20	9500
50	3500
60	6400
80	10033.3333
90	19333.3333
110	10150
	7000

Creating Groups of Data: GROUP BY Clause Syntax

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

- You can divide rows in a table into smaller groups by using the `GROUP BY` clause.

Using the GROUP BY Clause

- All columns in the SELECT list that are not in group functions must be in the GROUP BY clause.

```
SELECT    department_id, AVG(salary)
FROM      employees
GROUP BY department_id ;
```

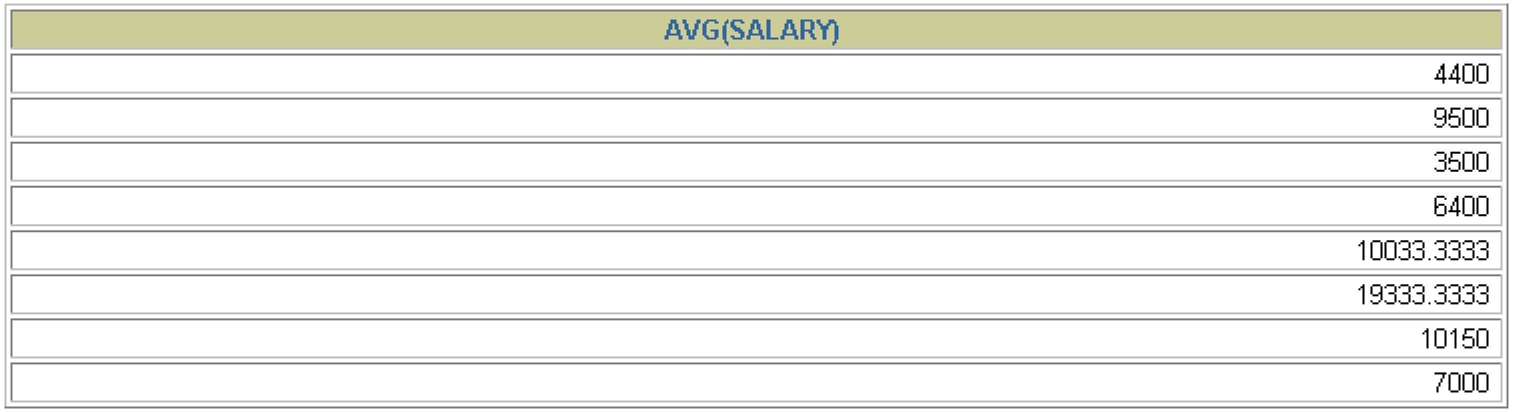
DEPARTMENT_ID	AVG(SALARY)
10	4400
20	9500
50	3500
60	6400
80	10033.3333
90	19333.3333
110	10150
	7000

8 rows selected.

Using the `GROUP BY` Clause

- The `GROUP BY` column does not have to be in the `SELECT` list.

```
SELECT   AVG(salary)
FROM     employees
GROUP BY department_id ;
```



AVG(SALARY)
4400
9500
3500
6400
10033.3333
19333.3333
10150
7000

Grouping by More Than One Column

EMPLOYEES

DEPARTMENT_ID	JOB_ID	SALARY
90	AD_PRES	24000
90	AD_VP	17000
90	AD_VP	17000
60	IT_PROG	9000
60	IT_PROG	6000
60	IT_PROG	4200
50	ST_MAN	5800
50	ST_CLERK	3500
50	ST_CLERK	3100
50	ST_CLERK	2600
50	ST_CLERK	2500
80	SA_MAN	10500
80	SA_REP	11000
80	SA_REP	8600

. . .

20	MK_REP	6000
110	AC_MGR	12000
110	AC_ACCOUNT	8300

20 rows selected.

Add the salaries in the EMPLOYEES table for each job, grouped by department

DEPARTMENT_ID	JOB_ID	SUM(SALARY)
10	AD_ASST	4400
20	MK_MAN	13000
20	MK_REP	6000
50	ST_CLERK	11700
50	ST_MAN	5800
60	IT_PROG	19200
80	SA_MAN	10500
80	SA_REP	19600
90	AD_PRES	24000
90	AD_VP	34000
110	AC_ACCOUNT	8300
110	AC_MGR	12000
	SA_REP	7000

13 rows selected.

Using the GROUP BY Clause on Multiple Columns

```
SELECT    department_id dept_id, job_id, SUM(salary)
FROM      employees
GROUP BY department_id, job_id ;
```

DEPT_ID	JOB_ID	SUM(SALARY)
10	AD_ASST	4400
20	MK_MAN	13000
20	MK_REP	6000
50	ST_CLERK	11700
50	ST_MAN	5800
60	IT_PROG	19200
80	SA_MAN	10500
80	SA_REP	19600
90	AD_PRES	24000
90	AD_VP	34000
110	AC_ACCOUNT	8300
110	AC_MGR	12000
	SA_REP	7000

13 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` clause:

```
SELECT department_id, COUNT(last_name)
FROM   employees;
```

```
SELECT department_id, COUNT(last_name)
       *
ERROR at line 1:
ORA-00937: not a single-group group function
```

Column missing in the `GROUP BY` clause

Illegal Queries Using Group Functions

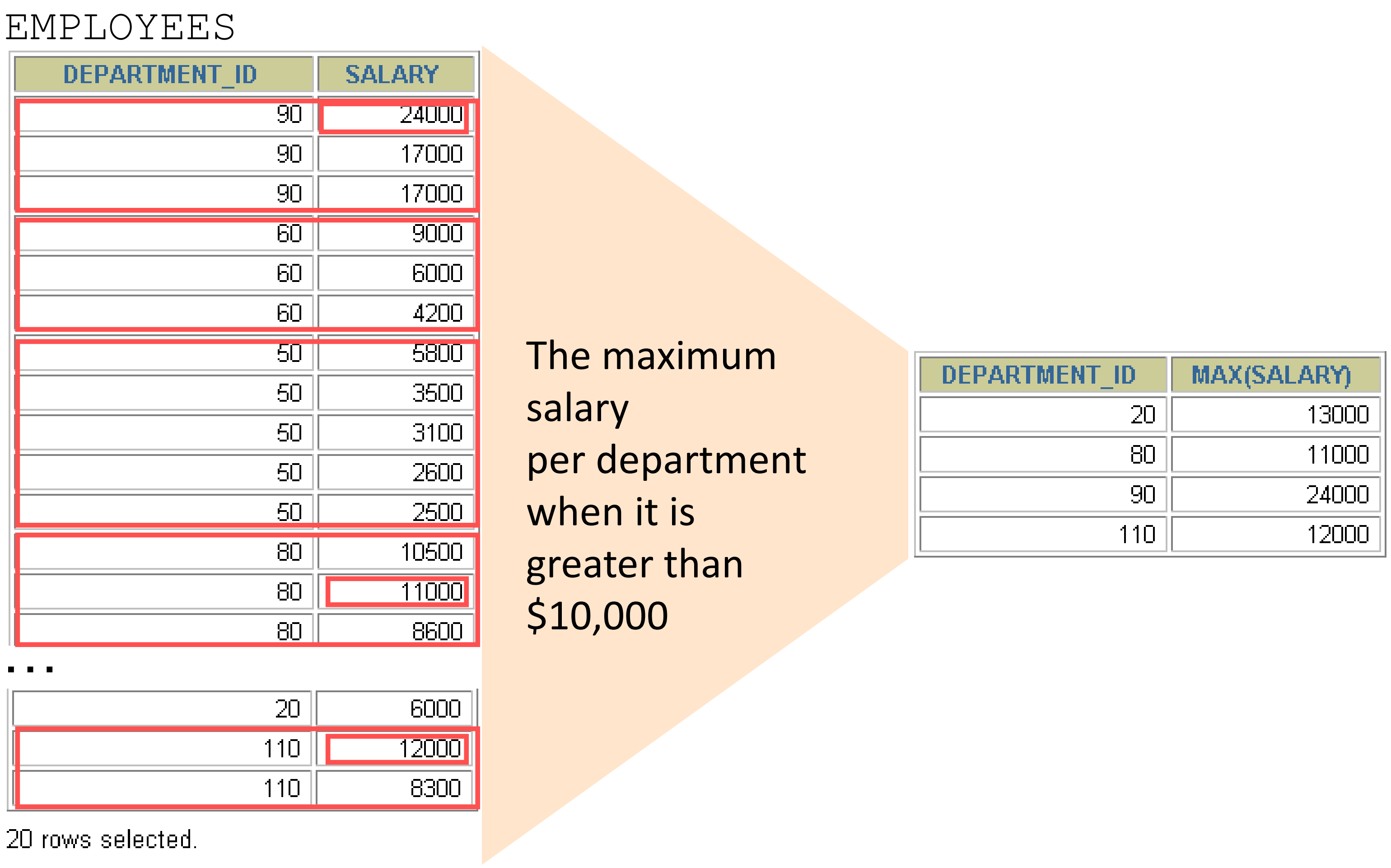
- You cannot use the WHERE clause to restrict groups.
- You use the HAVING clause to restrict groups.
- You cannot use group functions in the WHERE clause.

```
SELECT    department_id, AVG(salary)
FROM      employees
WHERE     AVG(salary) > 8000
GROUP BY department_id;
```

```
WHERE   AVG(salary) > 8000
        *
ERROR at line 3:
ORA-00934: group function is not allowed here
```

Cannot use the WHERE clause to restrict groups

Restricting Group Results



EMPLOYEES

DEPARTMENT_ID	SALARY
90	24000
90	17000
90	17000
60	9000
60	6000
60	4200
50	5800
50	3500
50	3100
50	2600
50	2500
80	10500
80	11000
80	8600

...

20	6000
110	12000
110	8300

20 rows selected.

The maximum salary per department when it is greater than $10,000

DEPARTMENT_ID	MAX(SALARY)
20	13000
80	11000
90	24000
110	12000

Restricting Group Results with the HAVING Clause

- When you use the HAVING clause, the Oracle server restricts groups as follows:
  1. Rows are grouped.
  2. The group function is applied.
  3. 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

```
SELECT    department_id, MAX(salary)
FROM      employees
GROUP BY  department_id
HAVING    MAX(salary)>10000 ;
```

DEPARTMENT_ID	MAX(SALARY)
20	13000
80	11000
90	24000
110	12000

Using the HAVING Clause

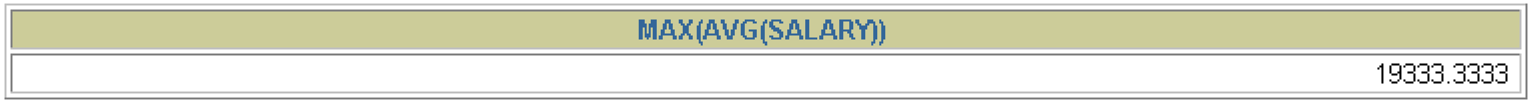
```
SELECT    job_id, SUM(salary) PAYROLL
FROM      employees
WHERE     job_id NOT LIKE '%REP%'
GROUP BY job_id
HAVING    SUM(salary) > 13000
ORDER BY SUM(salary);
```

JOB_ID	PAYROLL
IT_PROG	19200
AD_PRES	24000
AD_VP	34000

Nesting Group Functions

- Display the maximum average salary:

```
SELECT    MAX(AVG(salary))
FROM      employees
GROUP BY department_id;
```



MAX(AVG(SALARY))
19333.3333

Group functions can be nested to a depth of two.
The slide example displays the maximum average salary.

Summary

- In this lesson, you should have learned how to:
  - Use the group functions `COUNT`, `MAX`, `MIN`, and `AVG`
  - Write queries that use the `GROUP BY` clause
  - Write queries that use the `HAVING` clause

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