

5

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

Lesson Stanford

- Group functions:
 - Types and syntax
 - Use AVG, SUM, MIN, MAX, COUNT
 - Use DISTINCT keyword within group functions
 - NULL values in a group function
- Grouping rows:
 - GROUP BY clause
 - HAVING clause
- Nesting group functions

What Are Group Functions ?

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

EMPLOYEES

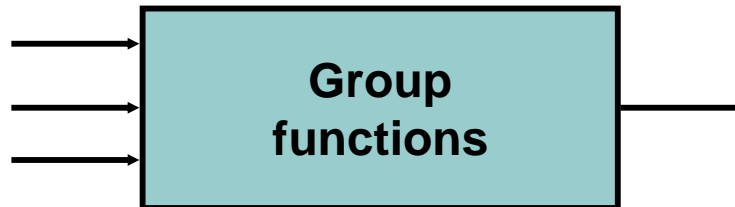
	DEPARTMENT_ID	SALARY
1	90	24000
2	90	17000
3	90	17000
4	60	9000
5	60	6000
6	60	4200
7	50	5800
8	50	3500
9	50	3100
10	50	2600
...		
18	20	6000
19	110	12000
20	110	8300

**Maximum salary in
EMPLOYEES table**

MAX(SALARY)
24000

Types of Group Functions

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







Group Functions: Syntax

```
SELECT      group_function(column), ...
FROM        table
[WHERE      condition]
[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)
1	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_DATE)	MAX(HIRE_DATE)
1	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(*)
1	5

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

2

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

	COUNT(COMMISSION_PCT)
1	3

Using the DISTINCT Keyword

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

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

	1	2	COUNT(DISTINCTDEPARTMENT_ID)
	1		7

Group Functions and Null Values

Group functions ignore null values in the column:

1

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

	AVG(COMMISSION_PCT)
1	0.2125

The NVL function forces group functions to include null values:

2

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

	AVG(NVL(COMMISSION_PCT,0))
1	0.0425

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Creating Groups of Data

EMPLOYEES

	DEPARTMENT_ID	SALARY	
1	10	4400	4400
2	20	13000	9500
3	20	6000	
4	50	5800	3500
5	50	2500	
6	50	2600	
7	50	3100	
8	50	3500	6400
9	60	4200	
10	60	6000	
11	60	9000	10033
12	80	11000	
13	80	10500	
14	80	8600	
...			
19	110	12000	
20	(null)	7000	

**Average salary in
EMPLOYEES table for
each department**

	DEPARTMENT_ID	AVG(SALARY)
1	10	4400
2	20	9500
3	50	3500
4	60	6400
5	80	10033.333333333333...
6	90	19333.333333333333...
7	110	10150
8	(null)	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)
1	(null)	7000
2	90	19333.3333333333...
3	20	9500
4	110	10150
5	50	3500
6	80	10033.3333333333...
7	60	6400
8	10	4400

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)
1	7000
2	19333.33333333333333333333...
3	9500
4	10150
5	3500
6	10033.33333333333333333333...
7	6400
8	4400

Grouping by More than One Column

EMPLOYEES

	DEPARTMENT_ID	JOB_ID	SALARY
1	10	AD_ASST	4400
2	20	MK_MAN	13000
3	20	MK_REP	6000
4	50	ST_MAN	5800
5	50	ST_CLERK	2500
6	50	ST_CLERK	2600
7	50	ST_CLERK	3100
8	50	ST_CLERK	3500
9	60	IT_PROG	4200
10	60	IT_PROG	6000
11	60	IT_PROG	9000
12	80	SA_REP	11000
13	80	SA_MAN	10500
14	80	SA_REP	8600
...			
19	110	AC_MGR	12000
20	(null)	SA_REP	7000

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

	DEPARTMENT_ID	JOB_ID	SUM(SALARY)
1	10	AD_ASST	4400
2	20	MK_MAN	13000
3	20	MK_REP	6000
4	50	ST_CLERK	11700
5	50	ST_MAN	5800
6	60	IT_PROG	19200
7	80	SA_MAN	10500
8	80	SA_REP	19600
9	90	AD_PRES	24000
10	90	AD_VP	34000
11	110	AC_ACCOUNT	8300
12	110	AC_MGR	12000
13	(null)	SA_REP	7000

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
ORDER BY  department_id;
```

	DEPARTMENT_ID	JOB_ID	SUM(SALARY)
1	10	AD_ASST	4400
2	20	MK_MAN	13000
3	20	MK_REP	6000
4	50	ST_CLERK	11700
5	50	ST_MAN	5800
6	60	IT_PROG	19200
7	80	SA_MAN	10500
8	80	SA_REP	19600
9	90	AD_PRES	24000
10	90	AD_VP	34000
11	110	AC_ACCOUNT	8300
12	110	AC_MGR	12000
13	(null)	SA_REP	7000

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;
```

ORA-00937: not a single-group group function
00937. 00000 - "not a single-group group function"

A `GROUP BY` clause must be added to count the last names for each `department_id`.

```
SELECT department_id, job_id, COUNT(last_name)
FROM employees
GROUP BY department_id;
```

ORA-00979: not a GROUP BY expression
00979. 00000 - "not a GROUP BY expression"

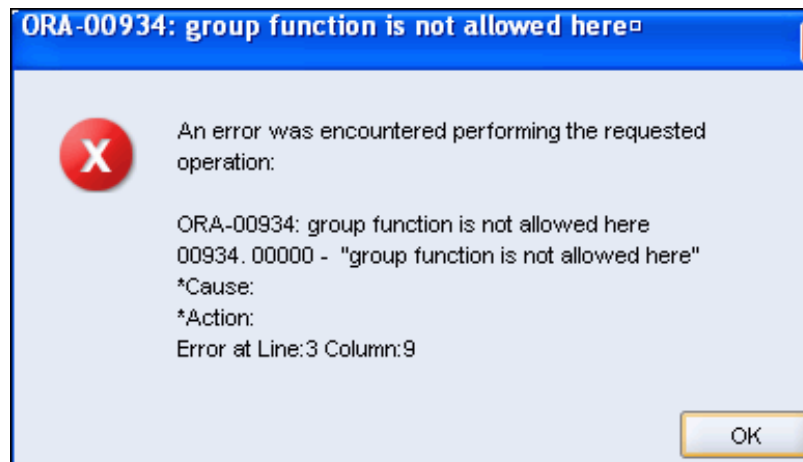
Either add `job_id` in the `GROUP BY` or remove the `job_id` column from the `SELECT` list.

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;
```



**Cannot use the
`WHERE` clause to
restrict groups**

Restricting Group Results

EMPLOYEES

	DEPARTMENT_ID	SALARY
1	10	4400
2	20	13000
3	20	6000
4	50	5800
5	50	2500
6	50	2600
7	50	3100
8	50	3500
9	60	4200
10	60	6000
11	60	9000
12	80	11000
13	80	10500
14	80	8600

...

18	110	8300
19	110	12000
20	(null)	7000

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

	DEPARTMENT_ID	MAX(SALARY)
1	20	13000
2	80	11000
3	90	24000
4	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)
1	90	24000
2	20	13000
3	110	12000
4	80	11000

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);
```

	<small>RZ</small> JOB_ID	<small>RZ</small> PAYROLL
1	IT_PROG	19200
2	AD_PRE	24000
3	AD_VP	34000

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Nesting Group Functions

Display the maximum average salary:

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

[illegible]

Summary

In this lesson, you should have learned how to:

- Use the group functions `COUNT`, `MAX`, `MIN`, `SUM`, 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];
```

Practice 5: Overview

This practice covers the following topics:

- Writing queries that use the group functions
- Grouping by rows to achieve more than one result
- Restricting groups by using the `HAVING` clause