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Restricting and Sorting Data

Objectives

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

- Limit the rows that are retrieved by a query
- Sort the rows that are retrieved by a query
- Use ampersand substitution to restrict and sort output at run time

Course Roadmap

Lesson 1: Introduction

Unit 1: Retrieving, Restricting and Sorting Data

Unit 2: Joins, Subqueries, and Set Operators

Unit 3: DML and DDL

Lesson 2: Retrieving Data using SQL `SELECT`

Lesson 3: Restricting and Sorting Data

You are here!

Lesson 4: Using Single-Row Functions to Customize Output

Lesson 5: Using Conversion Functions and Conditional Expressions

Lesson Agenda

- Limiting rows with:
  - The `WHERE` clause
  - The comparison operators using =, <=, `BETWEEN`, `IN`, `LIKE`, and `NULL` conditions
  - Logical conditions using `AND`, `OR`, and `NOT` operators
- Rules of precedence for operators in an expression
- Sorting rows using the `ORDER BY` clause
- SQL row limiting clause in a query
- Substitution variables
- `DEFINE` and `VERIFY` commands

Limiting Rows by Using a Selection

EMPLOYEES

	EMPLOYEE_ID	LAST_NAME	JOB_ID	DEPARTMENT_ID
1	100	King	AD_PRES	90
2	101	Kochhar	AD_VP	90
3	102	De Haan	AD_VP	90
4	103	Hunold	IT_PROG	60
5	104	Ernst	IT_PROG	60
6	107	Lorentz	IT_PROG	60

...

"retrieve all employees in department 90"

	EMPLOYEE_ID	LAST_NAME	JOB_ID	DEPARTMENT_ID
1	100	King	AD_PRES	90
2	101	Kochhar	AD_VP	90
3	102	De Haan	AD_VP	90

Limiting the Rows That Are Selected

- Restrict the rows that are returned by using the `WHERE` clause:

```
SELECT *|{[DISTINCT] column|expression [alias],...}
FROM   table
[WHERE condition(s)];
```

- The `WHERE` clause follows the `FROM` clause.

Using the WHERE Clause

```
SELECT employee_id, last_name, job_id, department_id
FROM   employees
WHERE  department_id = 90 ;
```

	EMPLOYEE_ID	LAST_NAME	JOB_ID	DEPARTMENT_ID
1	100	King	AD_PRES	90
2	101	Kochhar	AD_VP	90
3	102	De Haan	AD_VP	90

Character Strings and Dates

- Character strings and date values are enclosed within single quotation marks (' ').
- Character values are case-sensitive and date values are format-sensitive.
- The default display format for date is DD-MON-RR.

```
SELECT last_name, job_id, department_id
FROM   employees
WHERE  last_name = 'Whalen' ;
```

	LAST_NAME	JOB_ID	DEPARTMENT_ID
1	Whalen	AD_ASST	10

```
SELECT last_name
FROM   employees
WHERE  hire_date = '17-OCT-11' ;
```

	LAST_NAME
1	Rajs

Comparison Operators

Operator	Meaning
=	Equal to
>	Greater than
>=	Greater than or equal to
<	Less than
<=	Less than or equal to
<>	Not equal to
BETWEEN ...AND...	Between two values (inclusive)
IN(set)	Match any of a list of values
LIKE	Match a character pattern
IS NULL	Is a null value

Using Comparison Operators

Let us look at some examples:

```
SELECT last_name, salary
FROM   employees
WHERE  salary <= 3000 ;
```

	LAST_NAME	SALARY
1	Matos	2600
2	Vargas	2500

```
SELECT *
FROM   employees
WHERE  last_name = 'Abel';
```

	EMPLOYEE_ID	FIRST_NAME	LAST_NAME	EMAIL	PHONE_NUMBER	HIRE_DATE	JOB_ID	SALARY	COMMISSION_PCT	MANAGER_ID	DEPARTMENT_ID
1	174	Ellen	Abel	EABEL	011.44.1644.429267	11-MAY-12	SA_REP	11000	0.3	149	80

Using the BETWEEN Condition

- Use the BETWEEN condition to display rows based on a range of values:

```
SELECT last_name, salary
FROM   employees
WHERE  salary BETWEEN 2500 AND 3500 ;
```

Lower limit **Upper limit**

	LAST_NAME	SALARY
1	Rajs	3500
2	Davies	3100
3	Matos	2600
4	Vargas	2500

Using the IN Condition

- Use the IN membership condition to test for values in a list:

```
SELECT employee_id, last_name, salary, manager_id
FROM   employees
WHERE  manager_id IN (100, 101, 201) ;
```

	EMPLOYEE_ID	LAST_NAME	SALARY	MANAGER_ID
1	201	Hartstein	13000	100
2	101	Kochhar	17000	100
3	102	De Haan	17000	100
4	124	Mourgos	5800	100
5	149	Zlotkey	10500	100
6	200	Whalen	4400	101
7	205	Higgins	12000	101
8	202	Fay	6000	201

Using the LIKE Condition

- Use the LIKE condition to perform wildcard searches of valid search string values.
- Search conditions can contain either literal characters or numbers:
  - % denotes zero or many characters.
  - _ denotes one character.

```
SELECT   first_name
FROM     employees
WHERE    first_name LIKE 'S%' ;
```

	FIRST_NAME
1	Shelley
2	Steven

Using the LIKE Condition

- You can combine pattern-matching characters:

```
SELECT last_name
FROM   employees
WHERE  last_name LIKE '_o%' ;
```

	LAST_NAME
1	Kochhar
2	Lorentz
3	Mourgos

- You can use the ESCAPE identifier to search for the actual % and _ symbols.

Using the NULL Conditions

- Test for nulls with the `IS NULL` operator.

```
SELECT last_name, manager_id
FROM   employees
WHERE  manager_id IS NULL ;
```

	LAST_NAME	MANAGER_ID
1	King	(null)

Logical Conditions

Operator	Meaning
AND	Returns TRUE if *both* component conditions are true
OR	Returns TRUE if *either* component condition is true
NOT	Returns TRUE if the following condition is false

Using the AND Operator

AND requires both conditions to be true:

```
SELECT employee_id, last_name, job_id, salary
FROM   employees
WHERE  salary >=10000
AND    job_id LIKE '%MAN%' ;
```

	EMPLOYEE_ID	LAST_NAME	JOB_ID	SALARY
1	201	Hartstein	MK_MAN	13000
2	149	Zlotkey	SA_MAN	10500

Using the OR Operator

OR requires either condition to be true:

```
SELECT employee_id, last_name, job_id, salary
FROM   employees
WHERE  salary >= 10000
OR     job_id LIKE '%MAN%' ;
```

	EMPLOYEE_ID	LAST_NAME	JOB_ID	SALARY
1	201	Hartstein	MK_MAN	13000
2	205	Higgins	AC_MGR	12000
3	100	King	AD_PRES	24000
4	101	Kochhar	AD_VP	17000
5	102	De Haan	AD_VP	17000
6	124	Mourgos	ST_MAN	5800
7	149	Zlotkey	SA_MAN	10500
8	174	Abel	SA_REP	11000

Using the NOT Operator

```
SELECT last_name, job_id
FROM   employees
WHERE  job_id
       NOT IN ('IT_PROG', 'ST_CLERK', 'SA_REP') ;
```

	LAST_NAME	JOB_ID
1	De Haan	AD_VP
2	Fay	MK_REP
3	Gietz	AC_ACCOUNT
4	Hartstein	MK_MAN
5	Higgins	AC_MGR
6	King	AD_PRES
7	Kochhar	AD_VP
8	Mourgos	ST_MAN
9	Whalen	AD_ASST
10	Zlotkey	SA_MAN

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  - Logical conditions using `AND`, `OR`, and `NOT` operators
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Rules of Precedence

Operator	Meaning
1	Arithmetic operators
2	Concatenation operator
3	Comparison conditions
4	`IS [NOT] NULL, LIKE, [NOT] IN`
5	`[NOT] BETWEEN`
6	Not equal to
7	`NOT` logical condition
8	`AND` logical condition
9	`OR` logical condition

You can use parentheses to override rules of precedence.

Rules of Precedence

```
SELECT last_name, job_id, salary
FROM   employees
WHERE  job_id = 'SA_REP'
OR     job_id = 'AD_PRES'
AND    salary > 15000;
```

1

	LAST_NAME	JOB_ID	SALARY
1	King	AD_PRES	24000
2	Abel	SA_REP	11000
3	Taylor	SA_REP	8600
4	Grant	SA_REP	7000

```
SELECT last_name, job_id, salary
FROM   employees
WHERE  (job_id = 'SA_REP'
OR     job_id = 'AD_PRES')
AND    salary > 15000;
```

2

	LAST_NAME	JOB_ID	SALARY
1	King	AD_PRES	24000

Lesson Agenda

- Limiting rows with:
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Using the ORDER BY Clause

- Sort retrieved rows with the ORDER BY clause:
  - ASC: ascending order, default
  - DESC: descending order
- The ORDER BY clause comes last in the SELECT statement:

```
SELECT   last_name, job_id, department_id, hire_date
FROM     employees
ORDER BY hire_date ;
```

	LAST_NAME	JOB_ID	DEPARTMENT_ID	HIRE_DATE
1	King	AD_PRES	90	17-JUN-87
2	Whalen	AD_ASST	10	17-SEP-87
3	Kochhar	AD_VP	90	21-SEP-89
4	Hunold	IT_PROG	60	03-JAN-90
...				
20	Zlotkey	SA_MAN	80	29-JAN-00

Sorting

- Sorting in descending order:

```
SELECT   last_name, job_id, department_id, hire_date
FROM     employees
ORDER BY hire_date DESC ;
```

1

- Sorting by column alias:

```
SELECT employee_id, last_name, salary*12 annsal
FROM   employees
ORDER BY annsal ;
```

2

- Sorting by multiple columns:

```
SELECT last_name, department_id, salary
FROM   employees
ORDER BY department_id, salary DESC;
```

3

Sorting

- Sorting by using the column's numeric position:

```
SELECT   last_name, job_id, department_id, hire_date
FROM     employees
ORDER BY 3;
```

3

- Sorting by multiple columns:

```
SELECT last_name, department_id, salary
FROM   employees
ORDER BY department_id, salary DESC;
```

4

Lesson Agenda

- Limiting rows with:
  - The `WHERE` clause
  - The comparison conditions using =, <=, `BETWEEN`, `IN`, `LIKE`, and `NULL` operators
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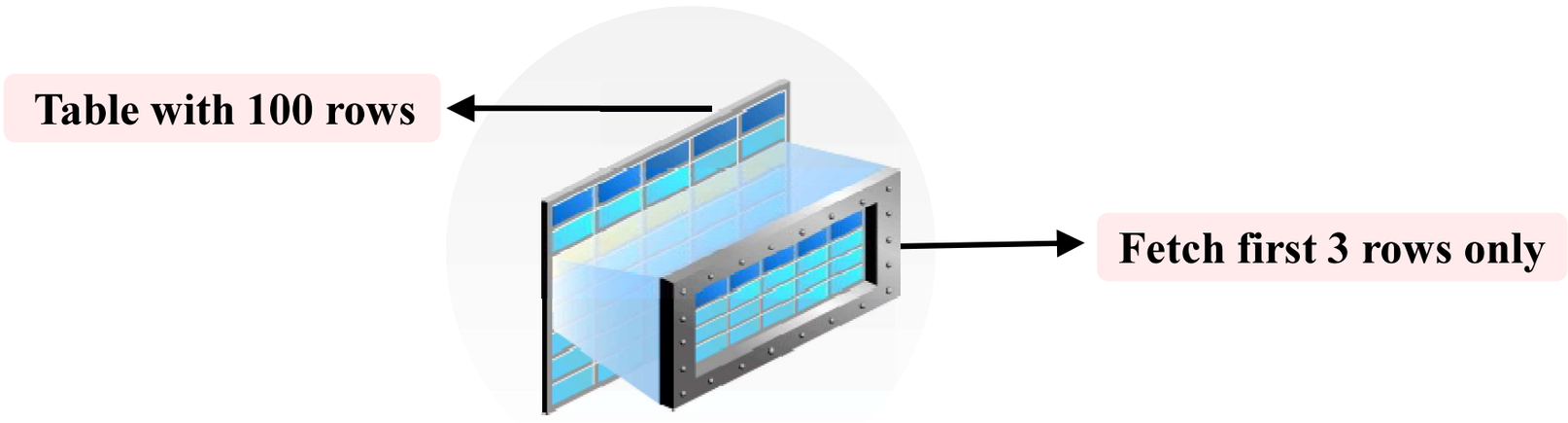
SQL Row Limiting Clause

- You can use the `row_limiting_clause` to limit the rows that are returned by a query.
- You can use this clause to implement Top-N reporting.



Using SQL Row Limiting Clause in a Query

- You specify the `row_limiting_clause` in the SQL `SELECT` statement by placing it after the `ORDER BY` clause.
- Syntax:

```
SELECT …
    FROM …
  [ WHERE …  ]
  [ ORDER BY …  ]
  [OFFSET offset { ROW | ROWS }]
[FETCH { FIRST | NEXT } [{ row_count | percent PERCENT
}] { ROW | ROWS }
   { ONLY | WITH TIES }]
```

SQL Row Limiting Clause: Example

```
SELECT employee_id, first_name
FROM employees
ORDER BY employee_id
FETCH FIRST 5 ROWS ONLY;
```

Script Output | Query Result

SQL | All Rows Fetched: 5

	EMPLOYEE_ID	FIRST_NAME
1	100	Steven
2	101	Neena
3	102	Lex
4	103	Alexander
5	104	Bruce

```
SELECT employee_id, first_name
FROM employees
ORDER BY employee_id
OFFSET 5 ROWS FETCH NEXT 5 ROWS ONLY;
```

	EMPLOYEE_ID	FIRST_NAME
1	107	Diana
2	124	Kevin
3	141	Trenna
4	142	Curtis
5	143	Randall

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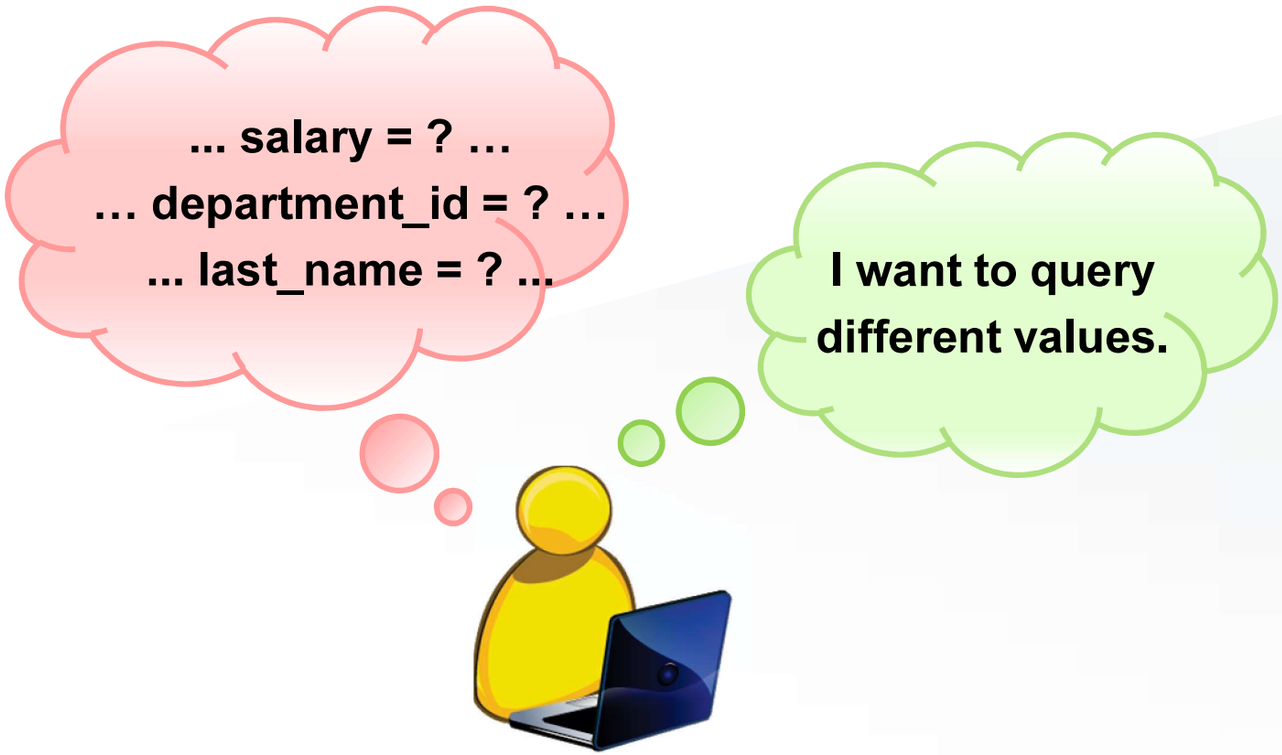
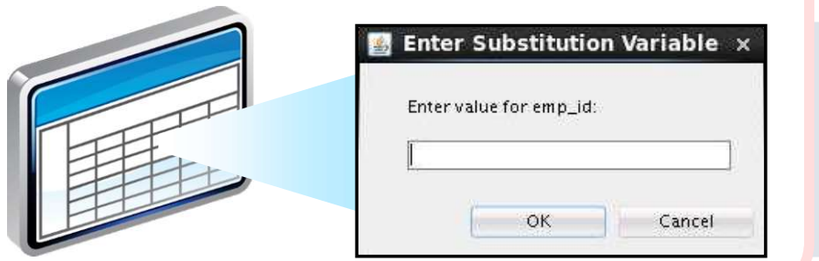
Substitution Variables



Substitution Variables

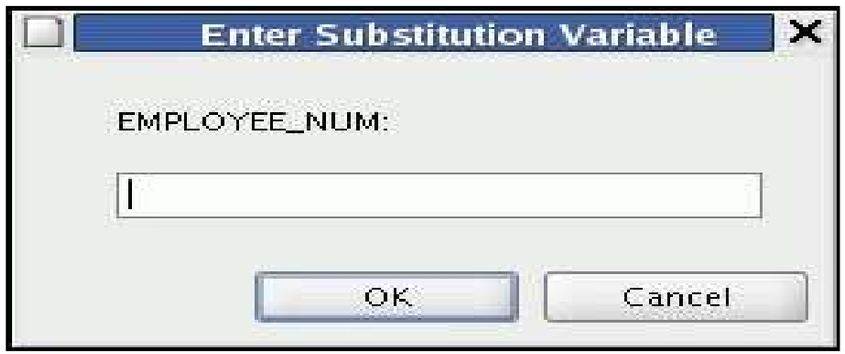
- Use substitution variables to:
  - Temporarily store values with single-ampersand (`&`) and double-ampersand (`&&`) substitution
- Use substitution variables to supplement the following:
  - `WHERE` conditions
  - `ORDER BY` clauses
  - Column expressions
  - Table names
  - Entire `SELECT` statements



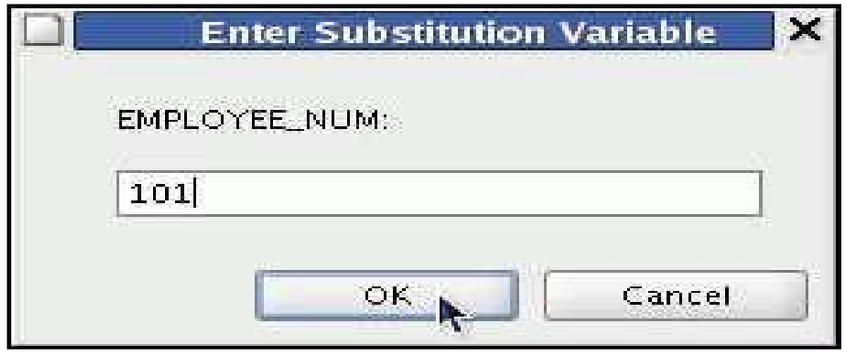
Using the & Substitution Variable

- Use a variable prefixed with an ampersand (&) to prompt the user for a value:

```
SELECT employee_id, last_name, salary, department_id
FROM   employees
WHERE  employee_id = &employee_num ;
```



Using the & Substitution Variable

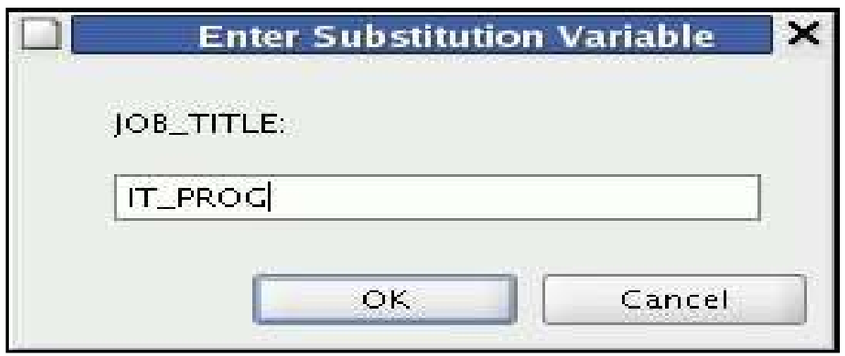


	EMPLOYEE_ID	LAST_NAME	SALARY	DEPARTMENT_ID
1	101	Kochhar	17000	90

Character and Date Values

- Use single quotation marks for date and character values:

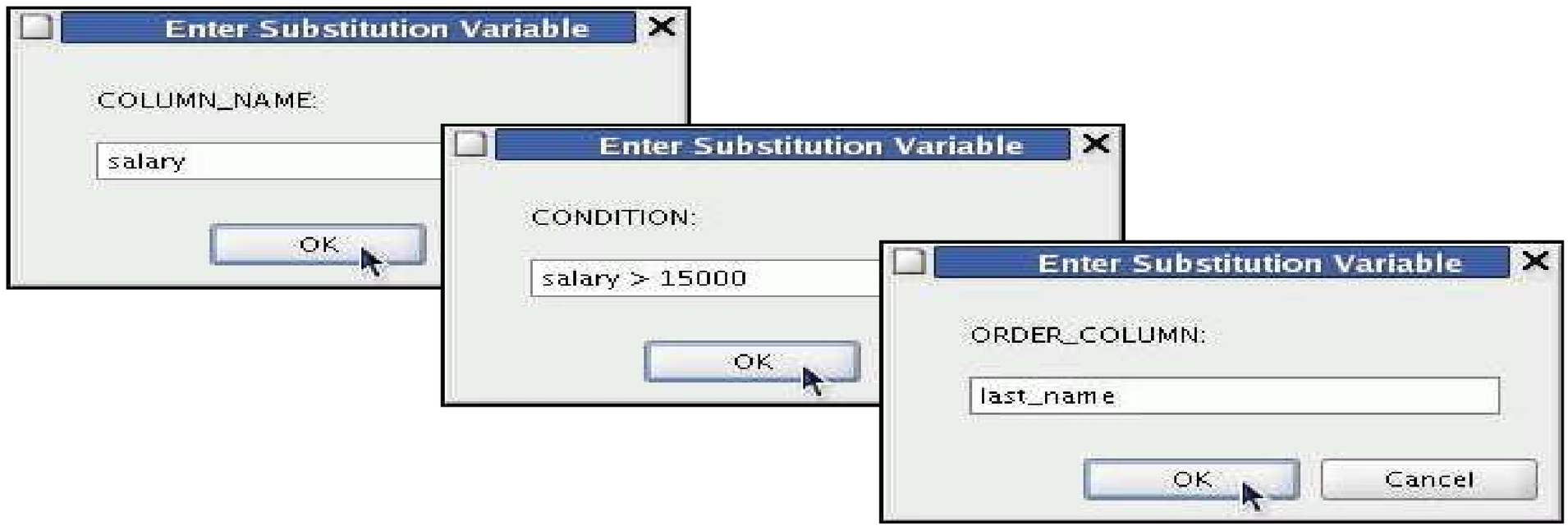
```
SELECT last_name, department_id, salary*12
FROM   employees
WHERE  job_id = '&job_title' ;
```



	LAST_NAME	DEPARTMENT_ID	SALARY*12
1	Hunold	60	108000
2	Ernst	60	72000
3	Lorentz	60	50400

Specifying Column Names,

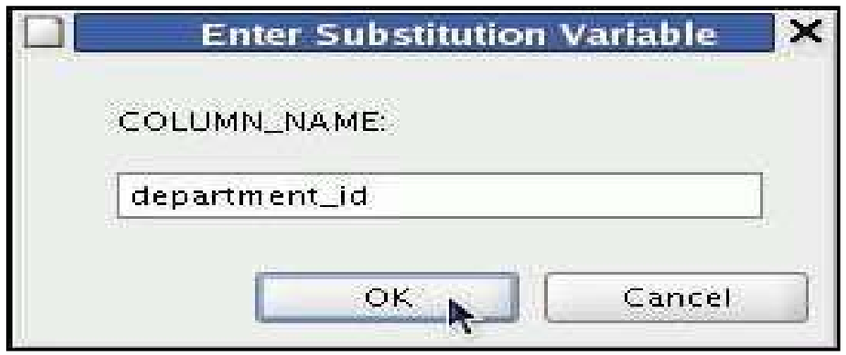
```
SELECT employee_id, last_name, job_id,&column_name
FROM   employees
WHERE  &condition
ORDER BY &order_column ;
```



Using the && Substitution Variable

- Use the double ampersand (&&) if you want to reuse the variable value without prompting the user each time:

```
SELECT   employee_id, last_name, job_id, &&column_name
FROM     employees
ORDER BY &column_name ;
```



	EMPLOYEE_ID	LAST_NAME	JOB_ID	DEPARTMENT_ID
1	200	Whalen	AD_ASST	10
...				
20	178	Grant	SA_REP	(null)

Using the DEFINE Command

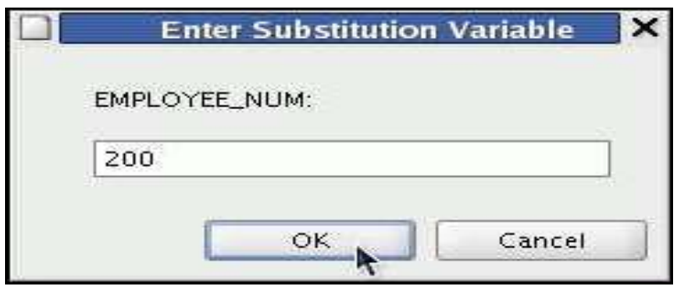
- Use the DEFINE command to create and assign a value to a variable.
- Use the UNDEFINE command to remove a variable.

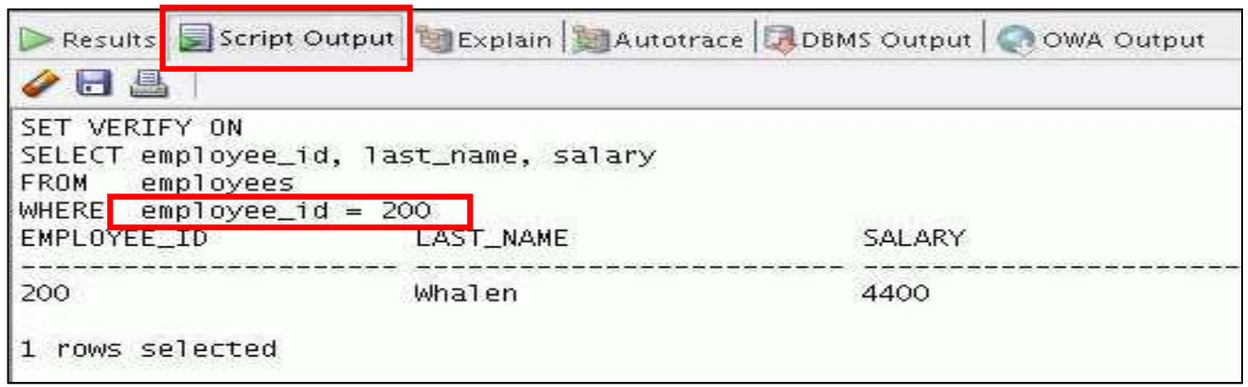
```
DEFINE employee_num = 200

SELECT employee_id, last_name, salary, department_id
FROM   employees
WHERE  employee_id = &employee_num ;

UNDEFINE employee_num
```

Using the VERIFY Command

- Use the VERIFY command to toggle the display of the substitution variable, both before and after SQL Developer replaces substitution variables with values:

```
SET VERIFY ON
SELECT employee_id, last_name, salary
FROM   employees
WHERE  employee_id = &employee_num;
```





Quiz

Which four of the following are valid operators for the `WHERE` clause?

a. >=

b. IS NULL

c. !=

d. IS LIKE

e. IN BETWEEN

f. <>

Summary

In this lesson, you should have learned how to:

- Limit the rows that are retrieved by a query
- Sort the rows that are retrieved by a query
- Use ampersand substitution to restrict and sort output at run time

```
SELECT  *|{[DISTINCT] column|expression [alias],...}
FROM    table
[WHERE  condition(s)]
[ORDER BY {column, expr, alias} [ASC|DESC]] ;
```

Practice 2: Overview

This practice covers the following topics:

- Selecting data and changing the order of the rows that are displayed
- Restricting rows by using the `WHERE` clause
- Sorting rows by using the `ORDER BY` clause
- Using substitution variables to add flexibility to your `SQL SELECT` statements