



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

Lesson Agenda

- Limiting rows with:
 - The `WHERE` clause
 - The comparison conditions 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
- Substitution variables
- `DEFINE` and `VERIFY` commands


Limiting Rows 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 with single quotation marks.
- Character values are case-sensitive and date values are format-sensitive.
- The default date display format is DD-MON-RR.

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

```
SELECT last_name
FROM   employees
WHERE  hire_date = '17-FEB-96' ;
```

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

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

	A Z LAST_NAME	A Z SALARY
1	Matos	2600
2	Vargas	2500

Range Conditions Using the BETWEEN Operator

Use the BETWEEN operator 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

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

Membership Condition Using the IN Operator

Use the `IN` operator to test for values in a list (alternatively `OR` operator can also be used):

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

Pattern Matching Using the LIKE Operator

- Use the `LIKE` operator 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%';
```

Combining Wildcard Characters

- You can combine the two wildcard characters (% , _) with literal characters for pattern matching:

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

	A Z	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 ;
```

	A Z LAST_NAME	A Z MANAGER_ID
1	King	(null)

Defining Conditions Using the Logical Operators

Operator	Meaning
AND	Returns TRUE if <i>both</i> component conditions are true
OR	Returns TRUE if <i>either</i> component condition is true
NOT	Returns TRUE if the condition is false

Using the AND Operator

AND requires both the component 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	149	Zlotkey	SA_MAN	10500
2	201	Hartstein	MK_MAN	13000

Using the OR Operator

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

Using the NOT Operator

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

	R2	LAST_NAME	R2	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

Lesson Agenda

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

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

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
5	Ernst	IT_PROG	60	21-MAY-91
6	De Haan	AD_VP	90	13-JAN-93

...

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

- Sorting by multiple columns:

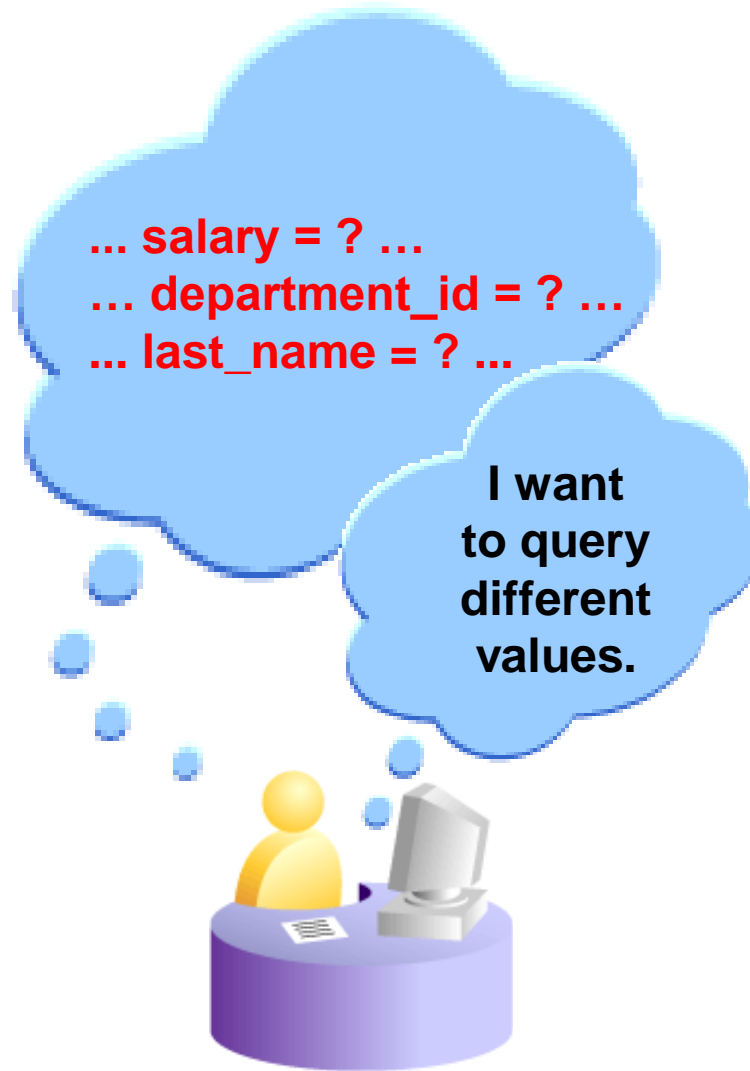
```
SELECT last_name, department_id, salary  
FROM employees  
ORDER BY department_id, salary DESC;
```

3

Lesson Agenda

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

Substitution Variables



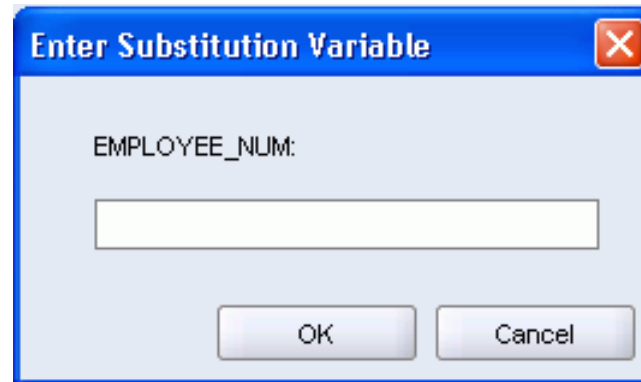
Substitution Variables

- 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

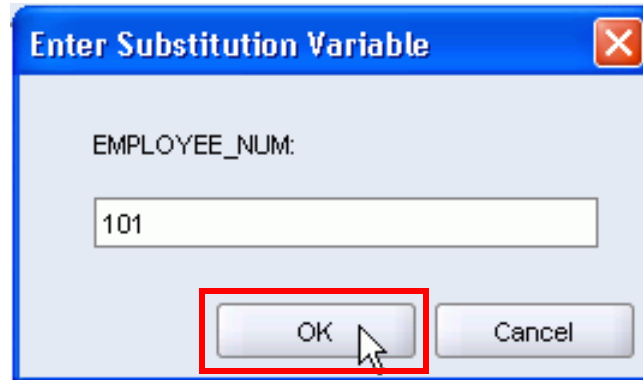
Using the Single-Ampersand Substitution Variable in Oracle

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 Single-Ampersand Substitution Variable



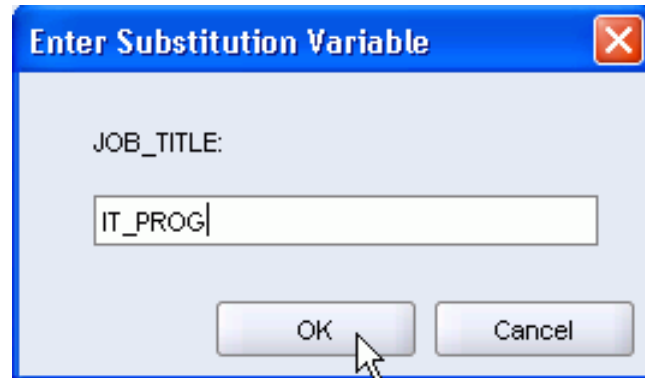
A dialog box titled "Enter Substitution Variable" with a close button (X) in the top right corner. The text "EMPLOYEE_NUM:" is displayed above a text input field containing the value "101". Below the input field, there are two buttons: "OK" and "Cancel". The "OK" button is highlighted with a red rectangular border, and a mouse cursor is pointing at it.

	EMPLOYEE_ID	LAST_NAME	SALARY	DEPARTMENT_ID
1	101	Kochhar	17000	90

Character and Date Values with Substitution Variables

Use single quotation marks for date and character values:

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

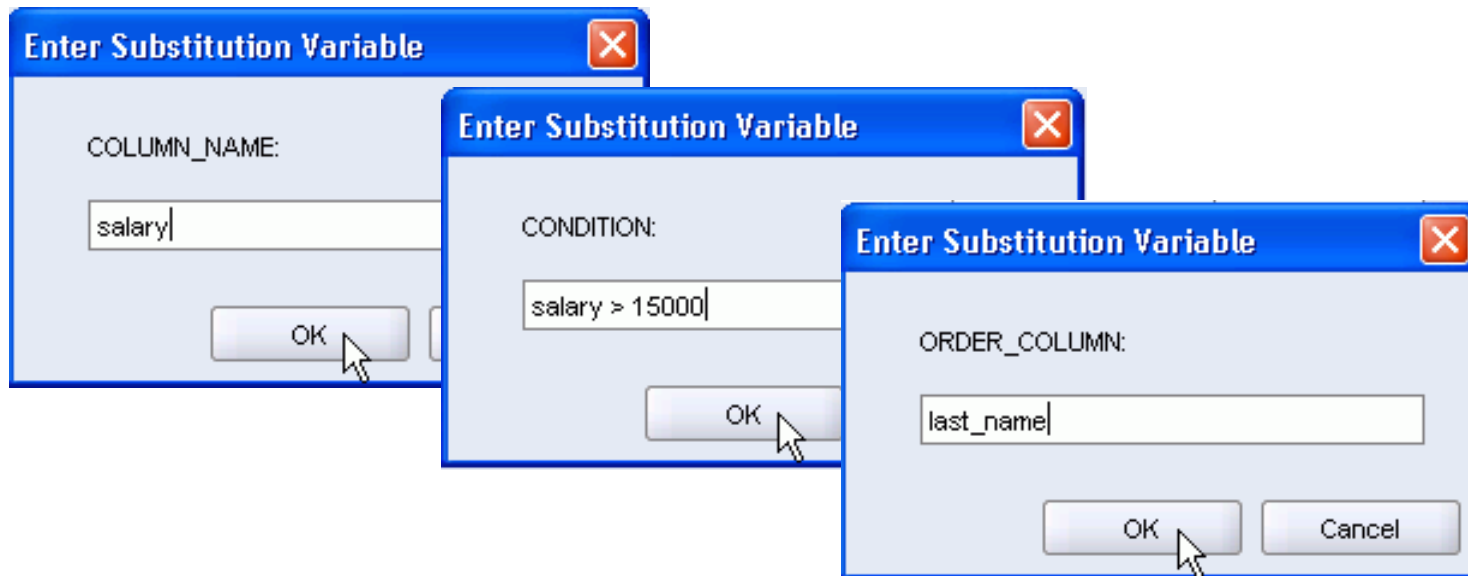


A dialog box titled "Enter Substitution Variable" with a close button (X) in the top right corner. It contains a label "JOB_TITLE:" followed by a text input field containing the value "IT_PROG". At the bottom, there are two buttons: "OK" and "Cancel". A mouse cursor is pointing at the "OK" button.

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

Specifying Column Names, Expressions, and Text

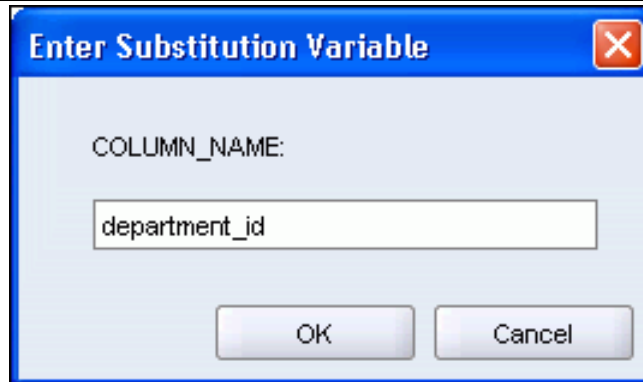
```
SELECT employee_id, last_name, job_id, &column_name  
FROM employees  
WHERE &condition  
ORDER BY &order_column ;
```



Using the Double-Ampersand Substitution Variable

Use 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 ;
```



A dialog box titled "Enter Substitution Variable" with a close button (X) in the top right corner. It contains a label "COLUMN_NAME:" followed by a text input field containing the value "department_id". At the bottom, there are "OK" and "Cancel" buttons.

	EMPLOYEE_ID	LAST_NAME	JOB_ID	DEPARTMENT_ID
1	200	Whalen	AD_ASST	10
2	201	Hartstein	MK_MAN	20
3	202	Fay	MK_REP	20

...


Lesson Agenda

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

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
```

A red arrow points from the value '200' in the DEFINE statement to the '&employee_num' placeholder in the WHERE clause of the SQL query, illustrating how the variable's value is substituted.

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;
```

Enter Substitution Variable

EMPLOYEE_NUM:

200

OK Cancel

Results Script Output Explain Autotrace DBMS Output

```
SELECT employee_id, last_name, salary
FROM   employees
WHERE  employee_id = 200
```

EMPLOYEE_ID	LAST_NAME	SALARY
200	Whalen	4400

1 rows selected

Quiz

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

- 1. >=
- 2. IS NULL
- 3. !=
- 4. IS LIKE
- 5. IN BETWEEN
- 6. <>

Summary

In this lesson, you should have learned how to:

- Use the `WHERE` clause to restrict rows of output:
 - Use the comparison conditions
 - Use the `BETWEEN`, `IN`, `LIKE`, and `NULL` operators
 - Apply the logical `AND`, `OR`, and `NOT` operators
- Use the `ORDER BY` clause to sort rows of output:

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

- Use ampersand substitution to restrict and sort output at run time

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