Oracle Database 11g

# SQL Fundamentals – Lab 1

## Lab Rules

- **You MUST attend in your section.**
- **Please commit to the lab start time.**
- **Oracle 11g INSTALLATION:**
  - **Refer to “ *Installation – Database.ppt*” for database installation**

## Structured Query Language (SQL)

## SQL, PL/SQL, and SQL*PLUS

- SQL**: Structured Query Language, What to do - NOT - How to do.

- PL/SQL**: Procedural Language SQL, a complete language that contains loops, if conditions, variables, cursors, procedures and functions…etc.**

- SQL Developer**: An execution environment to write SQL and PL/SQL (the program itself).**

## Data retrieval command (DRC)

## Basic `SELECT` Statement

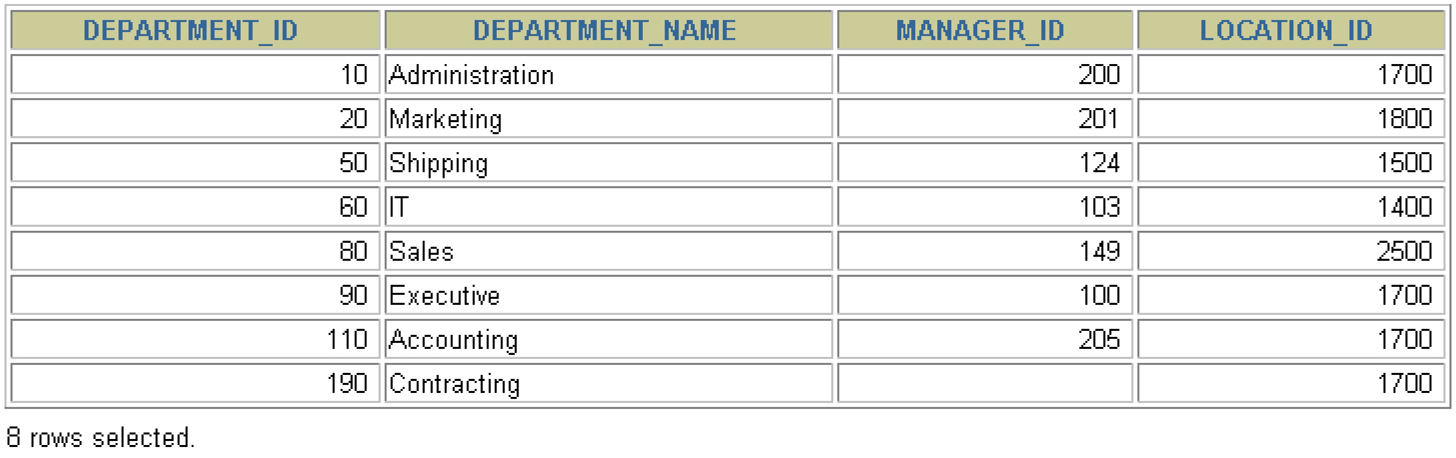
```
SELECT    *|{[DISTINCT] column|expression [alias],...}
FROM      table;
```

In its simplest form, a `SELECT` statement must include the following:

- `SELECT` identifies *what* columns
- `FROM` identifies *which* table

## Selecting All Columns

```
SELECT *
FROM   departments;
```

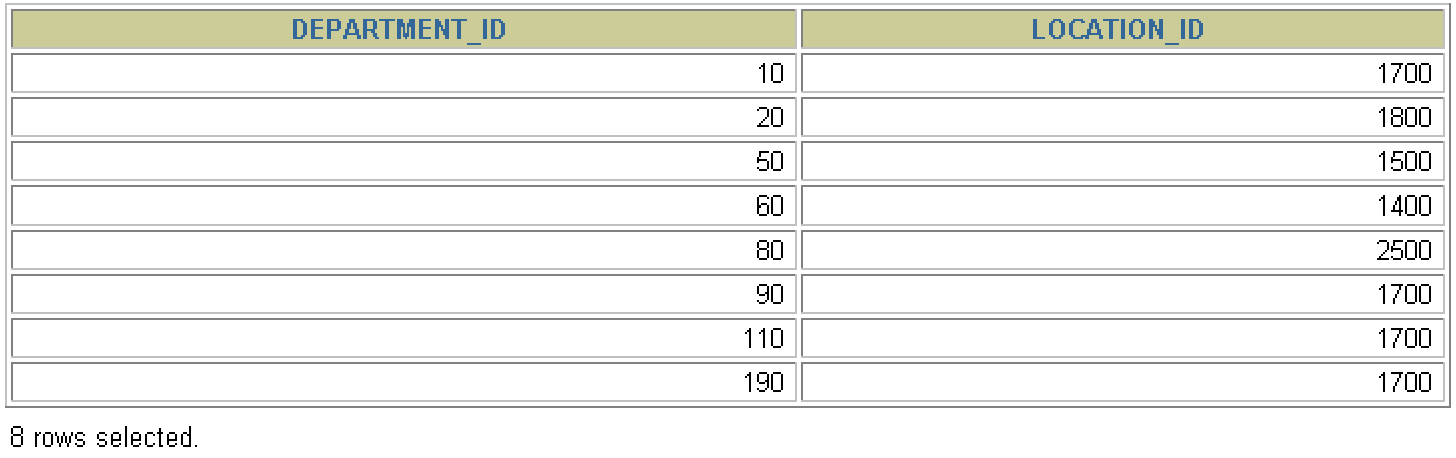


| DEPARTMENT_ID | DEPARTMENT_NAME | MANAGER_ID | LOCATION_ID |
|---:|---|---:|---:|
| 10 | Administration | 200 | 1700 |
| 20 | Marketing | 201 | 1800 |
| 50 | Shipping | 124 | 1500 |
| 60 | IT | 103 | 1400 |
| 80 | Sales | 149 | 2500 |
| 90 | Executive | 100 | 1700 |
| 110 | Accounting | 205 | 1700 |
| 190 | Contracting | | 1700 |

8 rows selected.

## Selecting Specific Columns

```
SELECT department_id, location_id
FROM   departments;
```



| DEPARTMENT_ID | LOCATION_ID |
|---:|---:|
| 10 | 1700 |
| 20 | 1800 |
| 50 | 1500 |
| 60 | 1400 |
| 80 | 2500 |
| 90 | 1700 |
| 110 | 1700 |
| 190 | 1700 |

```
8 rows selected.
```

In the `SELECT` clause, specify the columns that you want, in the order in which you want them to appear in the output.

# Using Arithmetic Operators

```
SELECT last_name, salary, salary + 300
FROM   employees;
```

| LAST_NAME | SALARY | SALARY+300 |
|---|---:|---:|
| King | 24000 | 24300 |
| Kochhar | 17000 | 17300 |
| De Haan | 17000 | 17300 |
| Hunold | 9000 | 9300 |
| Ernst | 6000 | 6300 |

…

| | | |
|---|---:|---:|
| Hartstein | 13000 | 13300 |
| Fay | 6000 | 6300 |
| Higgins | 12000 | 12300 |
| Gietz | 8300 | 8600 |

20 rows selected.

- Note that the resultant calculated column SALARY+300 is not a new column in the EMPLOYEES table; it is for display only. By default, the name of a new column comes from the calculation “salary+300”

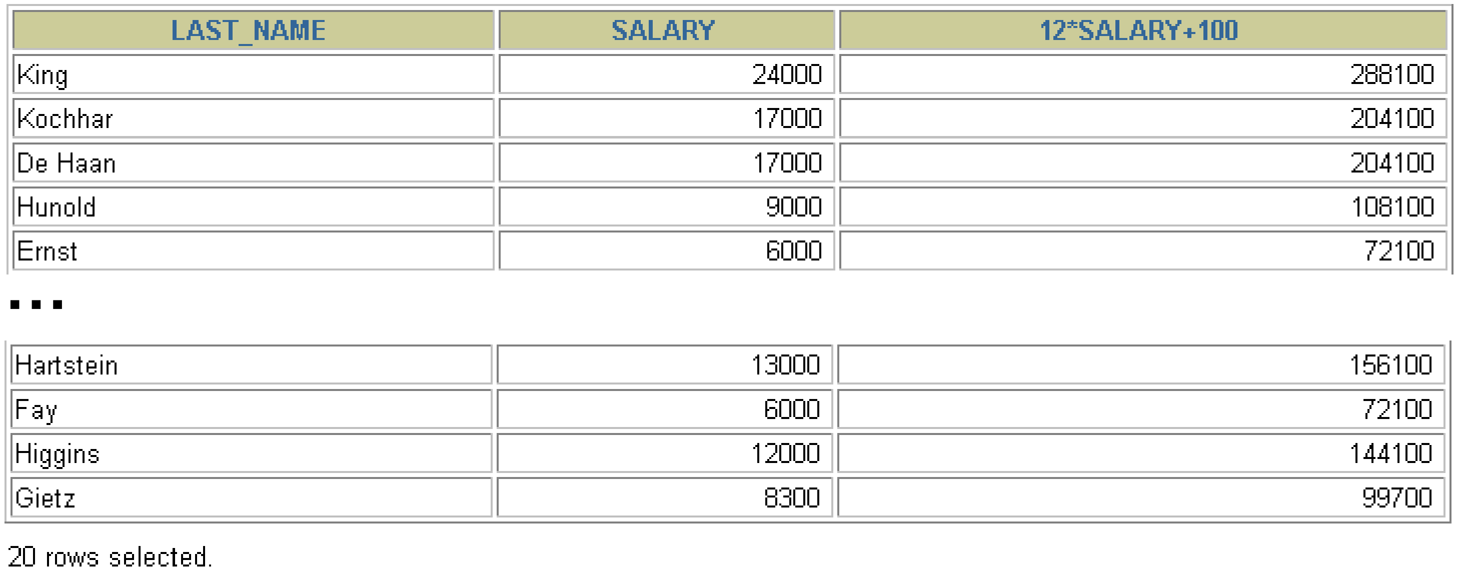
## Operator Precedence

* / + -

- Multiplication and division take priority over addition and subtraction.
- Operators from the same priority are evaluated from left to right.
- Parentheses are used to enforce prioritized evaluation and to clarify statements.

## Operator Precedence

```
SELECT last_name, salary, 12*salary+100
FROM   employees;
```



| LAST_NAME | SALARY | 12*SALARY+100 |
|---|---|---|
| King | 24000 | 288100 |
| Kochhar | 17000 | 204100 |
| De Haan | 17000 | 204100 |
| Hunold | 9000 | 108100 |
| Ernst | 6000 | 72100 |

...

|  |  |  |
|---|---|---|
| Hartstein | 13000 | 156100 |
| Fay | 6000 | 72100 |
| Higgins | 12000 | 144100 |
| Gietz | 8300 | 99700 |

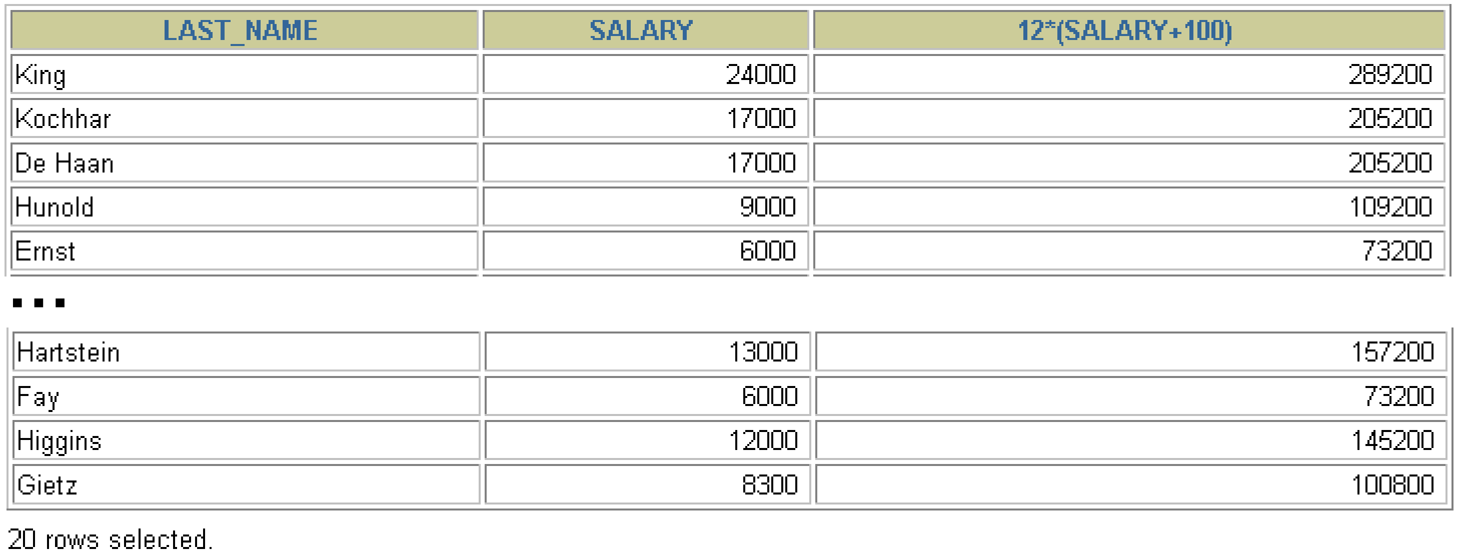
20 rows selected.

```
SELECT last_name, salary, salary+100*12

FROM    employees;
```

# Using Parentheses

```
SELECT last_name, salary, 12*(salary+100)
FROM   employees;
```



| LAST_NAME | SALARY | 12*(SALARY+100) |
|---|---|---|
| King | 24000 | 289200 |
| Kochhar | 17000 | 205200 |
| De Haan | 17000 | 205200 |
| Hunold | 9000 | 109200 |
| Ernst | 6000 | 73200 |

...

|  |  |  |
|---|---|---|
| Hartstein | 13000 | 157200 |
| Fay | 6000 | 73200 |
| Higgins | 12000 | 145200 |
| Gietz | 8300 | 100800 |

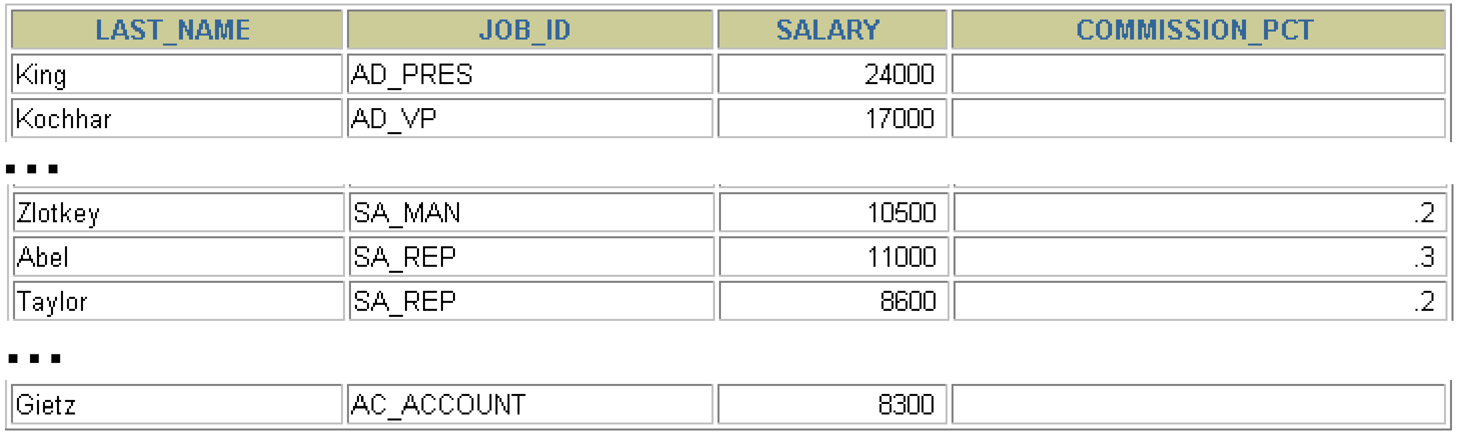
20 rows selected.

You can override the rules of precedence by using parentheses to specify the order in which operators are executed.

## Defining a Null Value

- A null is a value that is unavailable, unassigned, unknown, or inapplicable.
- A null is not the same as zero or a blank space.

```
SELECT last_name, job_id, salary, commission_pct
FROM   employees;
```



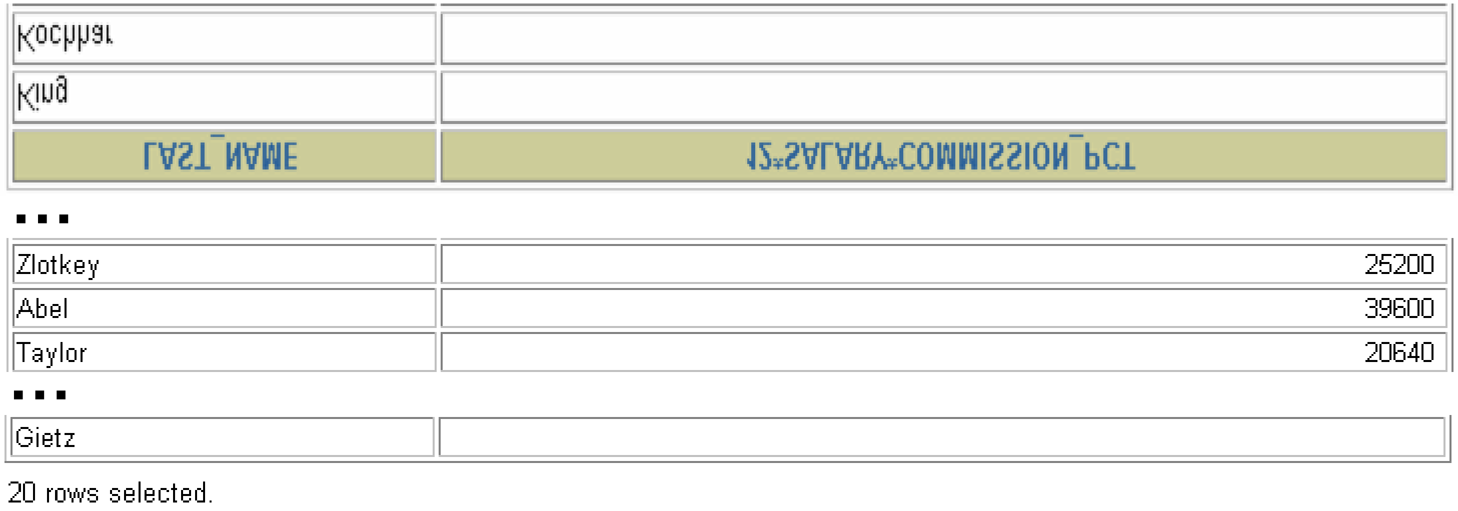
| LAST_NAME | JOB_ID | SALARY | COMMISSION_PCT |
|---|---|---|---|
| King | AD_PRES | 24000 | |
| Kochhar | AD_VP | 17000 | |
| ... | | | |
| Zlotkey | SA_MAN | 10500 | .2 |
| Abel | SA_REP | 11000 | .3 |
| Taylor | SA_REP | 8600 | .2 |
| ... | | | |
| Gietz | AC_ACCOUNT | 8300 | |

20 rows selected.

# Null Values in Arithmetic Expressions

**Arithmetic expressions containing a null value evaluate to null.**

```
SELECT last_name, 12*salary*commission_pct
FROM   employees;
```



| LAST_NAME | 12*SALARY*COMMISSION_PCT |
|---|---|
| King | |
| Kochhar | |

...

| | |
|---|---|
| Zlotkey | 25200 |
| Abel | 39600 |
| Taylor | 20640 |

...

| | |
|---|---|
| Gietz | |

20 rows selected.

## Defining a Column Alias

A column alias:

- Renames a column heading
- Is useful with calculations
- Immediately follows the column name
- The optional `AS` keyword may be used between the column name and alias
- Requires double quotation marks if it contains spaces or special characters or is case sensitive

## Using Column Aliases

```
SELECT last_name AS name, commission_pct comm
FROM   employees;
```

| NAME | COMM |
|---|---|
| King | |
| Kochhar | |
| De Haan | |

...

20 rows selected.

```
SELECT last_name "Name", salary*12 "Annual Salary"
FROM   employees;
```

| Name | Annual Salary |
|---|---|
| King | 288000 |
| Kochhar | 204000 |
| De Haan | 204000 |

...

20 rows selected.

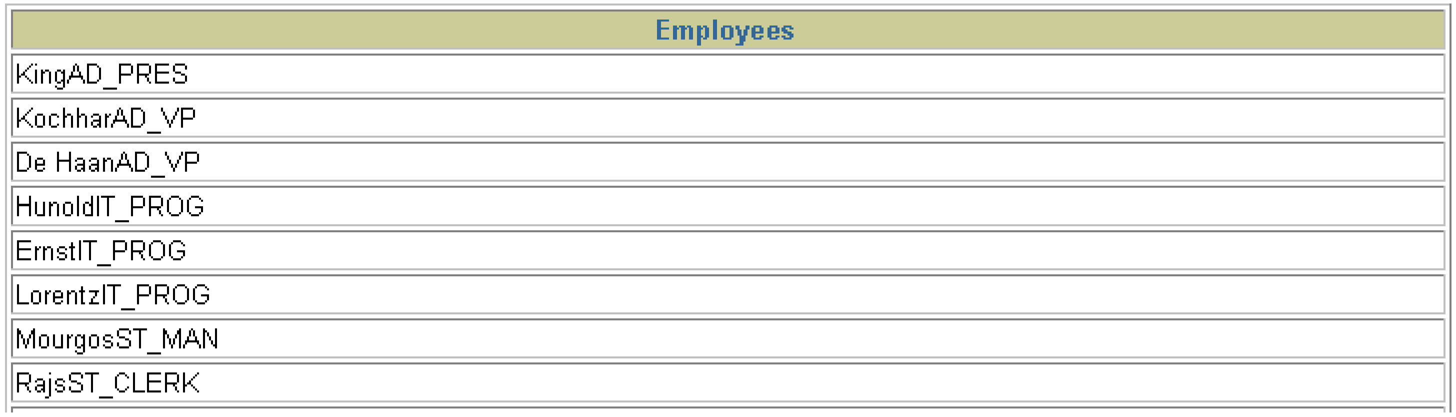
## Concatenation Operator

A concatenation operator:

- Concatenates columns or character strings to other columns
- Is represented by two vertical bars (||)
- Creates a resultant column that is a character expression

# Using the Concatenation Operator

```
SELECT last_name || job_id AS "Employees"
FROM   employees;
```



| Employees |
|---|
| KingAD_PRES |
| KochharAD_VP |
| De HaanAD_VP |
| HunoldIT_PROG |
| ErnstIT_PROG |
| LorentzIT_PROG |
| MourgosST_MAN |
| RajsST_CLERK |

...

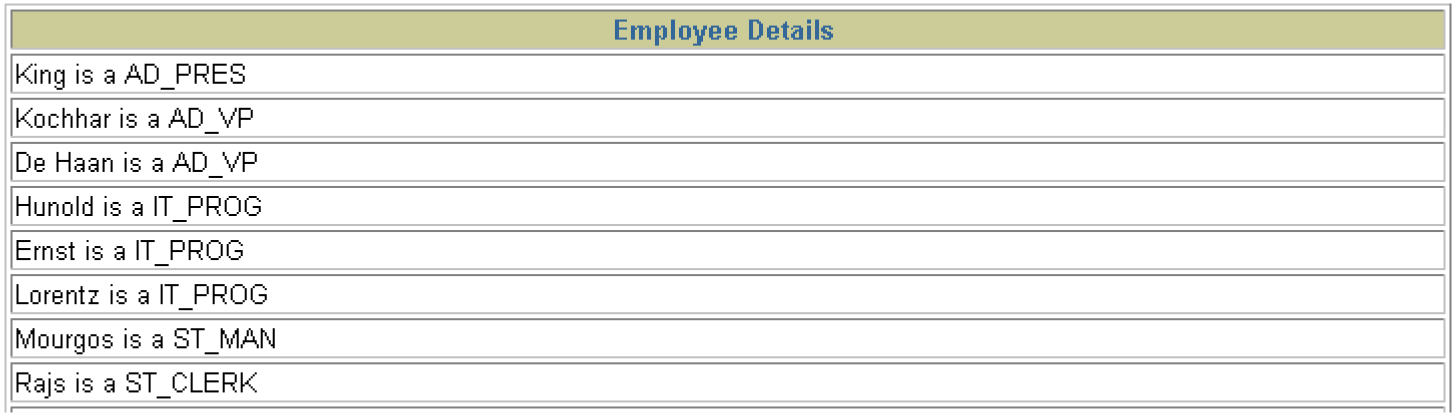
20 rows selected.

## Literal Character Strings

- A literal is a character, a number, or a date included in the SELECT list.
- Date and character literal values must be enclosed within single quotation marks.
- Each character string is output once for each row returned.

## Using Literal Character Strings

```
SELECT last_name  || ' is a ' || job_id
       AS "Employee Details"
FROM   employees;
```



| Employee Details |
|---|
| King is a AD_PRES |
| Kochhar is a AD_VP |
| De Haan is a AD_VP |
| Hunold is a IT_PROG |
| Ernst is a IT_PROG |
| Lorentz is a IT_PROG |
| Mourgos is a ST_MAN |
| Rajs is a ST_CLERK |

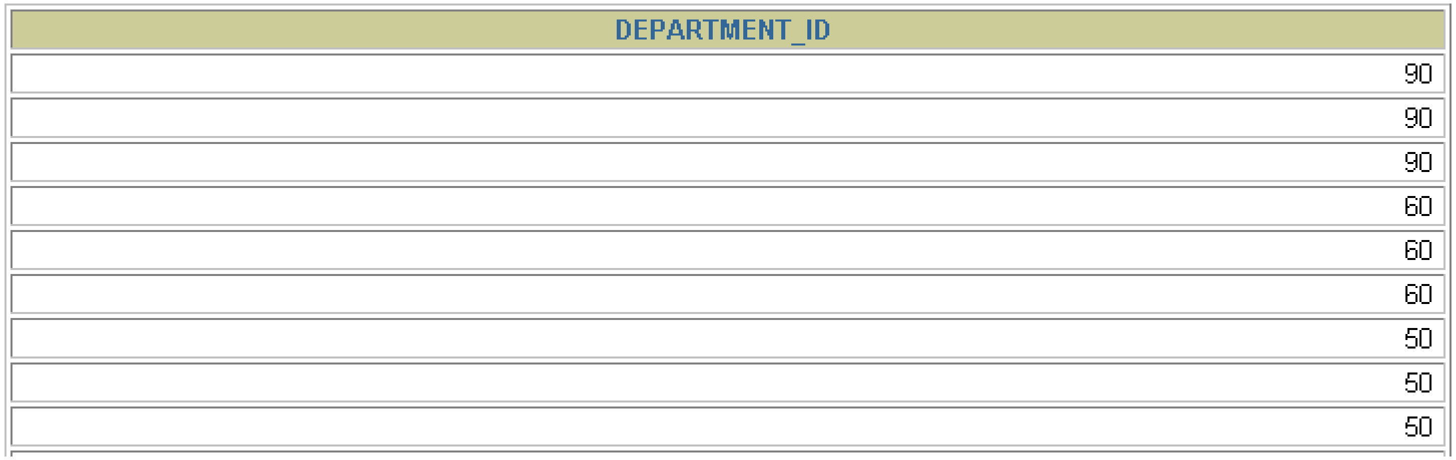
...

20 rows selected.

## Duplicate Rows

**The default display of queries is all rows, including duplicate rows.**

```
SELECT department_id
FROM   employees;
```

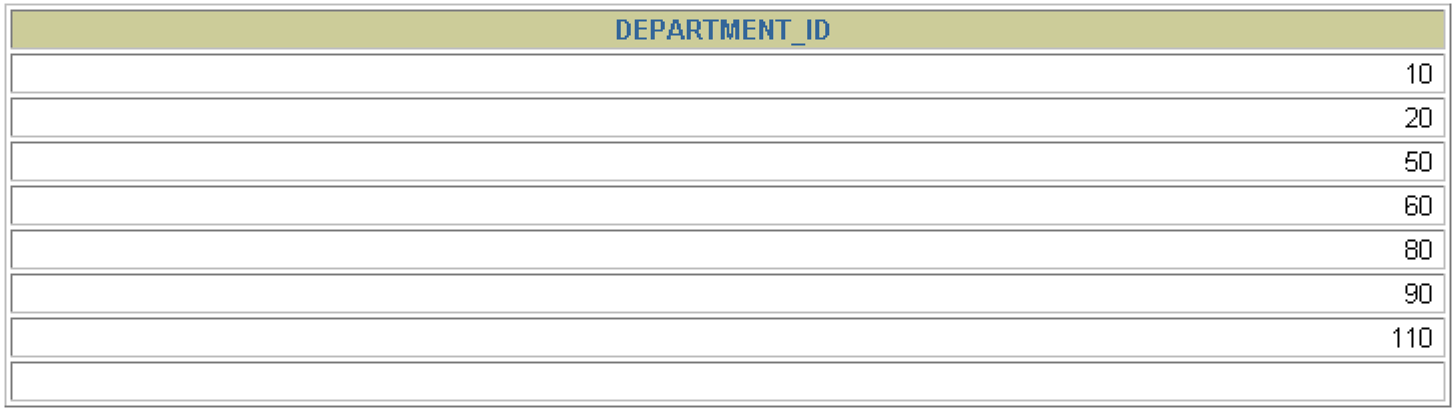


```
DEPARTMENT_ID
           90
           90
           90
           60
           60
           60
           50
           50
           50
…
20 rows selected.
```

# Eliminating Duplicate Rows

**Eliminate duplicate rows by using the `DISTINCT` keyword in the `SELECT` clause.**

```
SELECT DISTINCT department_id
FROM   employees;
```



| DEPARTMENT_ID |
|---:|
| 10 |
| 20 |
| 50 |
| 60 |
| 80 |
| 90 |
| 110 |
| |

8 rows selected.

## Eliminating Duplicate Rows

- You can specify multiple columns after the DISTINCT qualifier. The DISTINCT qualifier affects all the selected columns, and the result is every distinct combination of the columns.

- You can not specify columns before the DISTINCT qualifier.

## Restricting Data

# Limiting the Rows Selected

- Restrict the rows returned by using the **`WHERE`** clause.

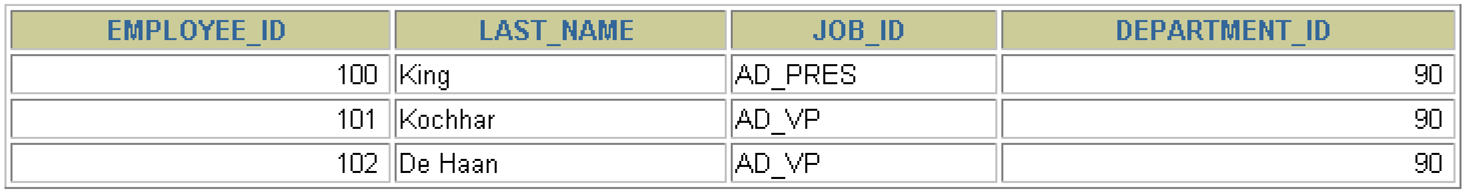
```
SELECT   *|{[DISTINCT] column|expression [alias],...}
FROM     table
[WHERE   condition(s)];
```

- The **`WHERE`** clause follows the **`FROM`** clause. It consists of three elements:
  - Column name
  - Comparison operator
  - Column name, constant, or list of values

# Using the WHERE Clause

A WHERE clause contains a condition that must be met.
If the condition is true, the row meeting the condition is returned.

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



| EMPLOYEE_ID | LAST_NAME | JOB_ID | DEPARTMENT_ID |
|---|---|---|---|
| 100 | King | AD_PRES | 90 |
| 101 | Kochhar | AD_VP | 90 |
| 102 | De Haan | AD_VP | 90 |

= Equal , < Less than , > Greater than , <> Not equal

## Character Strings and Dates

- Character strings and date values are enclosed in single quotation marks.
- Character values are case sensitive
- Date values are format sensitive.

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

► All character searches are case sensitive.

## Using Comparison Conditions

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

| LAST_NAME | SALARY |
|---|---|
| Matos | 2600 |
| Vargas | 2500 |

## Other Comparison Conditions

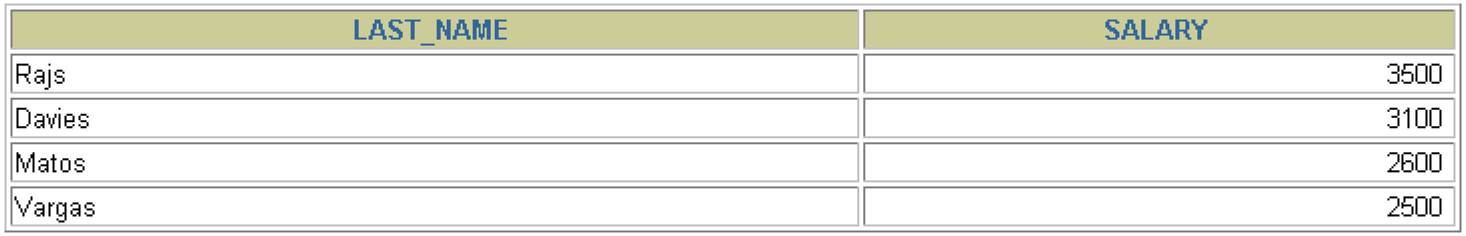
| Operator | Meaning |
|---|---|
| `BETWEEN ...AND...` | Between two values (inclusive), |
| `IN(set)` | Match any of a list of values |
| `LIKE` | Match a character pattern |
| `IS NULL` | Is a null value |

## 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 |
|---|---|
| Rajs | 3500 |
| Davies | 3100 |
| Matos | 2600 |
| Vargas | 2500 |

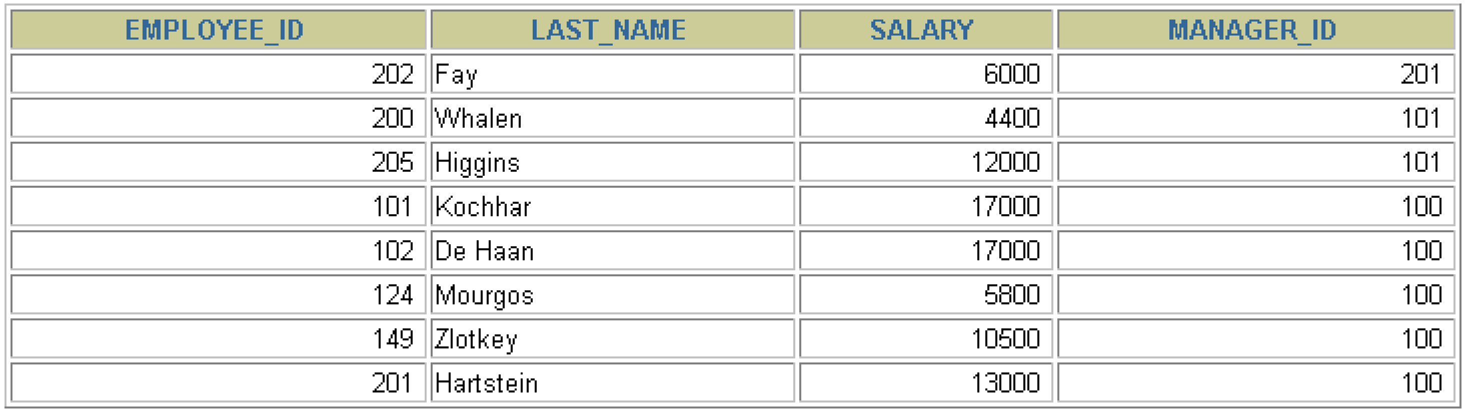
Values specified with the BETWEEN condition are **inclusive**.

You must specify the **lower** limit **first**.

# The IN Condition

- Use the **IN** membership condition to test for values in a list.
- The **IN** operator can be used with any datatype.

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



| EMPLOYEE_ID | LAST_NAME | SALARY | MANAGER_ID |
|---:|---|---:|---:|
| 202 | Fay | 6000 | 201 |
| 200 | Whalen | 4400 | 101 |
| 205 | Higgins | 12000 | 101 |
| 101 | Kochhar | 17000 | 100 |
| 102 | De Haan | 17000 | 100 |
| 124 | Mourgos | 5800 | 100 |
| 149 | Zlotkey | 10500 | 100 |
| 201 | Hartstein | 13000 | 100 |

8 rows selected.

## 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%';
```

## The LIKE Condition

– The following example displays the last names and hire dates of all employees who joined between January 1995 and December 1995:

```
SELECT last_name, hire_date
FROM   employees
WHERE  hire_date LIKE '%95';
```

## Using the `LIKE` Condition

- You can combine pattern-matching characters.

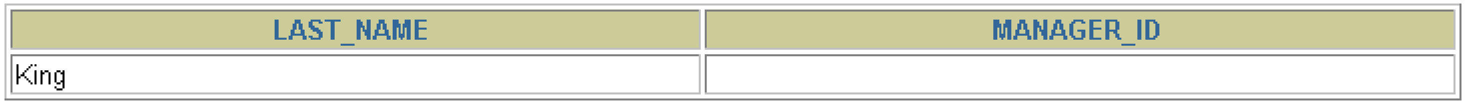
```
SELECT last_name
FROM   employees
WHERE  last_name LIKE '_o%';
```

| LAST_NAME |
|---|
| Kochhar |
| Lorentz |
| Mourgos |

# 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 |
|---|---|
| King | |

## 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 |

You can use several conditions in one `WHERE` clause using the `AND` and `OR` operators.

## Using the AND Operator

AND requires both conditions to be true.

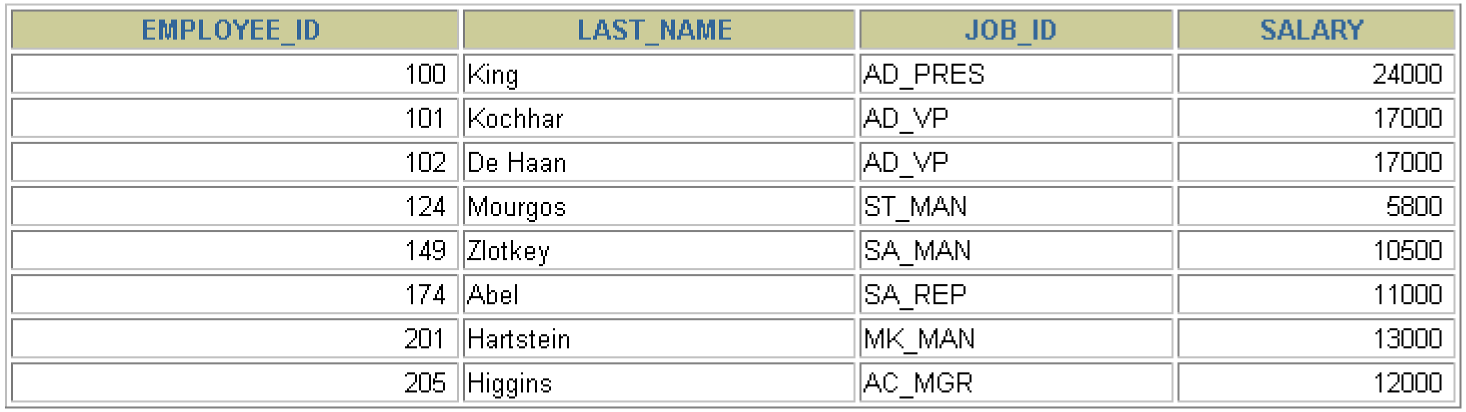
```
SELECT employee_id, last_name, job_id, salary
FROM   employees
WHERE  salary >=10000
AND    job_id LIKE '%MAN%';
```

| EMPLOYEE_ID | LAST_NAME | JOB_ID | SALARY |
|---|---|---|---|
| 149 | Zlotkey | SA_MAN | 10500 |
| 201 | Hartstein | MK_MAN | 13000 |

## 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 |
|---|---|---|---|
| 100 | King | AD_PRES | 24000 |
| 101 | Kochhar | AD_VP | 17000 |
| 102 | De Haan | AD_VP | 17000 |
| 124 | Mourgos | ST_MAN | 5800 |
| 149 | Zlotkey | SA_MAN | 10500 |
| 174 | Abel | SA_REP | 11000 |
| 201 | Hartstein | MK_MAN | 13000 |
| 205 | Higgins | AC_MGR | 12000 |

8 rows selected.

# 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 |
|---|---|
| King | AD_PRES |
| Kochhar | AD_VP |
| De Haan | AD_VP |
| Mourgos | ST_MAN |
| Zlotkey | SA_MAN |
| Whalen | AD_ASST |
| Hartstein | MK_MAN |
| Fay | MK_REP |
| Higgins | AC_MGR |
| Gietz | AC_ACCOUNT |

10 rows selected.

## Sorting Data

## The ORDER BY Clause

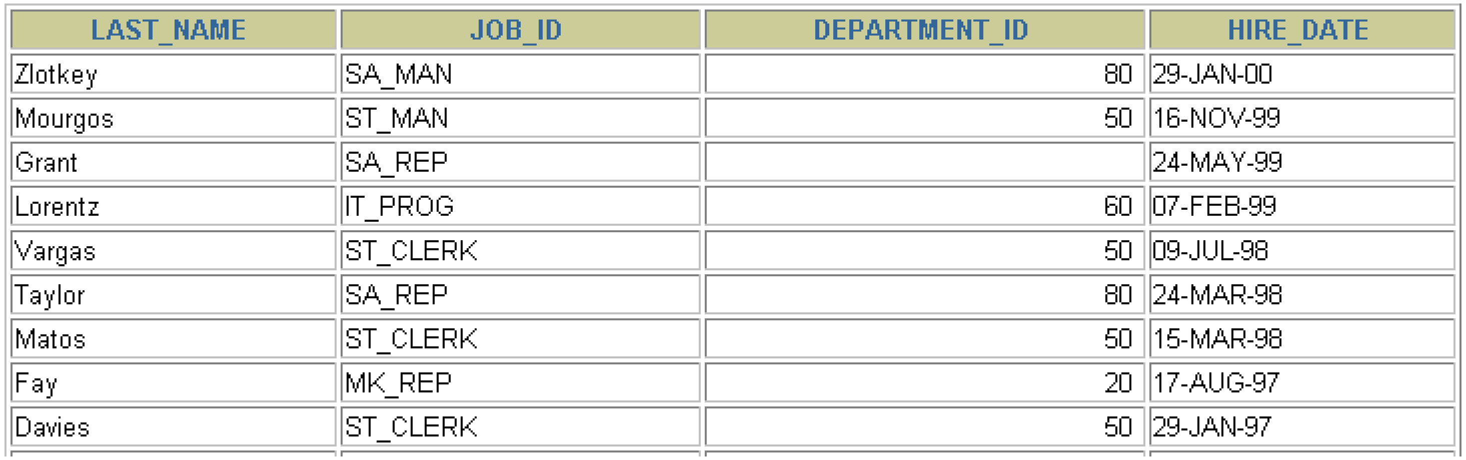
- The ORDER BY clause is last in SELECT statement.
- The default sort order is ascending.
- You can sort by column name, expressions or aliases.
- Null values are displayed:
  - Last for ascending order
  - First for descending order

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

# Sorting in Descending Order

- The sort order can be reversed by using DESC.

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



| LAST_NAME | JOB_ID | DEPARTMENT_ID | HIRE_DATE |
|---|---|---|---|
| Zlotkey | SA_MAN | 80 | 29-JAN-00 |
| Mourgos | ST_MAN | 50 | 16-NOV-99 |
| Grant | SA_REP | | 24-MAY-99 |
| Lorentz | IT_PROG | 60 | 07-FEB-99 |
| Vargas | ST_CLERK | 50 | 09-JUL-98 |
| Taylor | SA_REP | 80 | 24-MAR-98 |
| Matos | ST_CLERK | 50 | 15-MAR-98 |
| Fay | MK_REP | 20 | 17-AUG-97 |
| Davies | ST_CLERK | 50 | 29-JAN-97 |

20 rows selected.

## Sorting by Multiple Columns

- The order of ORDER BY clause list is order of sort.

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

- You can order by position, e.g. 2nd column in select clause.

```
SELECT   last_name, job_id, department_id, hire_date
FROM     employees
ORDER BY 2;
```

- You can sort by a column that is not in the SELECT list.

## General Syntax

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

# Thank You