Database Programming with SQL

1-3

Anatomy of a SQL Statement

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Objectives

- This lesson covers the following objectives:
  - Match projection and selection with their correct capabilities
  - Create a basic SELECT statement
  - Use the correct syntax to display all rows in a table
  - Use the correct syntax to select specific columns in a table, modify the way data is displayed, and perform calculations using arithmetic expressions and operators

Objectives

- This lesson covers the following objectives:
  - Formulate queries using correct operator precedence to display desired results
  - Define a null value
  - Demonstrate the effect null values create in arithmetic expressions
  - Construct a query using a column alias

DP 1-3
Anatomy of a SQL Statement

4

SELECT Keyword

- SELECT is one of the most important, if not the most important, keyword in SQL

- You use SELECT to retrieve information from the database. When you learn how to use SELECT, you've opened the door to the database

- Imagine a database containing information about movies such as title, genre, studio, producer, release date, series, country, language, rating, running time, and so on

- What if you only wanted the titles of movies created in India?

- The SELECT statement allows you to search for specific data

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5

SELECT Statement

- The SELECT statement retrieves information from the database
- The syntax for a SELECT statement is as follows:

```
SELECT <column_name(s)>
FROM <table_name>;
```

- In its simplest form, a SELECT statement must include the following:
  - A SELECT clause, which specifies the columns to be displayed
  - A FROM clause, which specifies the table containing the columns listed in the SELECT clause

DP 1-3
Anatomy of a SQL Statement

6

SELECT clause: Specifies the columns to be displayed (or use * symbol to display all columns).

FROM clause: Specifies the table containing the column(s) listed in the select clause.

Column: An implementation of an attribute or relationship in a table.

Conventions

- Throughout this course, the following will be used:

```
SELECT last_name
FROM employees;
```

- A keyword refers to an individual SQL command

- For example, SELECT and FROM are keywords

- A clause is a part of a SQL statement

- For example, SELECT last_name is a clause

- A statement is a combination of two or more clauses

- For example, SELECT last_name FROM employees is a statement

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7

The following SQL style conventions are used throughout this course:

SQL Keywords in UPPERCASE – e.g. SELECT, FROM, WHERE.

Column and table names in lower case – e.g. first_name, employees.

Each clause on a new line – e.g.

SELECT last_name

FROM employees

WHERE employee_id = 101;

Capabilities of SELECT Statements

- Projection:
  - Used to choose columns in a table
- Selection:
  - Used to choose rows in a table

Table 2: Projection

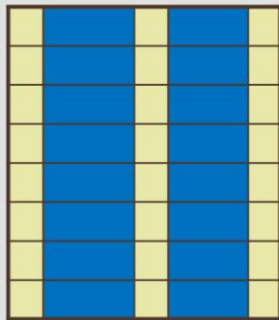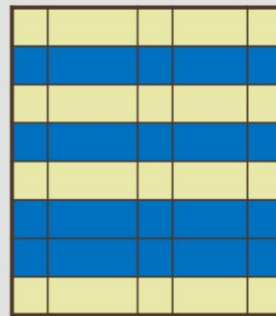**Table 2: Selection**

Projection: You can use the projection capability in SQL to choose the columns in a table that you want returned by your query. You can choose as few or as many columns of the table as you require.

Selection: You can use the selection capability in SQL to choose the rows in a table that you want returned by a query. You can use various criteria to restrict the rows that you see

Projection and Selection

ID	FIRST_NAME	LAST_NAME	SALARY
10	John	Doe	4000
20	Jane	Jones	3000
30	Sylvia	Smith	5000
40	Hai	Nguyen	6000

Projection

Selection

```
SELECT salary
FROM employees
WHERE last_name LIKE
'Smith';
```

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The SELECT clause determines Projection.

The WHERE clause determines Selection.

The execution of this query would result in the display of the salary column for any employees with the last_name Smith.

Selecting All Columns

- You can display all of the columns of data in a table by using an asterisk symbol (*) instead of a column name in the SELECT clause

- In the example shown, all of the columns in the countries table are selected

```
SELECT *
FROM countries;
```

COUNTRY_ID	COUNTRY_NAME	REGION_ID
CA	Canada	2
DE	Germany	1
UK	United Kingdom	1
US	United States of America	2

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Sometimes doing a SELECT * FROM table can take a long time to return the data. It all depends on the number of rows stored in that particular table. Remember, Oracle tables can store millions of rows of data.

Selecting All Columns

- You can also display all the columns in a table by listing them individually

```
SELECT country_id, country_name, region_id
FROM countries;
```

COUNTRY_ID	COUNTRY_NAME	REGION_ID
CA	Canada	2
DE	Germany	1
UK	United Kingdom	1
US	United States of America	2

All examples on the slides have a semicolon after each statement. Oracle Application Express does not require this syntax, but other Oracle SQL Interfaces do, so we have included them in the courseware.

Projecting Specific Columns

- If you want to PROJECT only specific columns from a table to be displayed, simply list each of the column names you want and separate each name with a comma in the SELECT clause

```
SELECT location_id, city, state_province
FROM locations;
```

LOCATION_ID	CITY	STATE_PROVINCE
1800	Toronto	Ontario
2500	Oxford	Oxford
1400	Southlake	Texas
1500	South San Francisco	California
1700	Seattle	Washington

12

12

Using Arithmetic Operators

- Using a few simple rules and guidelines, you can construct SQL statements that are both easy to read and easy to edit

- Knowing the rules will make learning SQL easy

- You may need to modify the way in which data is displayed, perform calculations, or look at what-if scenarios

- For example, "What if every employee was given a 5% raise?

- How would that affect our yearly profit figures?"

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Anatomy of a SQL Statement

13

Using Arithmetic Operators

- These types of calculations are all possible using arithmetic expressions
- You are already familiar with arithmetic expressions in mathematics:
  - add (+), subtract (-) , multiply (*) and divide (/)
- Note that this example does not create new columns in the tables or change the actual data values
- The results of the calculations will appear only in the output

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14

Arithmetic expression: an expression that results in a numeric value.

Using Arithmetic Operators

- The example shown uses the addition operator to calculate a salary increase of 300 for all employees and displays a new SALARY + 300 column in the output

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

- Putting in blank spaces before and after an arithmetic operator will not affect the output

LAST_NAME	SALARY	SALARY+300
King	24000	24300
Kochhar	17000	17300
De Haan	17000	17300
Whalen	4400	4700
Higgins	12000	12300
Gietz	8300	8600
Zlotkey	10500	10800
Abel	11000	11300
Taylor	8600	8900
Grant	7000	7300

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Anatomy of a SQL Statement

Arithmetic operator: A symbol used to perform an operation on some values

Precedence in Arithmetic Operators

- Precedence is the order in which Oracle evaluates different operators in the same expression

- When evaluating an expression containing multiple operators, Oracle evaluates operators with higher precedence before evaluating those with lower precedence

- Oracle evaluates operators with equal precedence from left to right within an expression

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16

Precedence in Arithmetic Operators

- Arithmetic operators perform the mathematical operations of Multiplication, Division, Addition, and Subtraction

- If these operators appear together in an expression, multiplication and division are evaluated first.

- So the order is: * / + -

- An easy way to remember their operator precedence is the mnemonic device: My Dear Aunt Sally

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Precedence in Arithmetic Operators

- If operators within an expression are of the same priority, then evaluation is done from left to right

- You can always use parentheses to force the expression within parentheses to be evaluated first

- In the example tables shown on the next slide, note the differences in the output between the query that used parentheses and the one that didn't

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18

Precedence in Arithmetic Operators

Operator Precedence	Using Parentheses

`SELECT last_name, salary,`
`        12*salary +100`
`FROM employees;`
	`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
Whalen	4400	52900
Higgins	12000	144100
Gietz	8300	99700

LAST_NAME	SALARY	12*(SALARY+100)
King	24000	289200
Kochhar	17000	205200
De Haan	17000	205200
Whalen	4400	54000
Higgins	12000	145200
Gietz	8300	100800

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DP 1-3
Anatomy of a SQL Statement

19

The example on the left uses Operator Precedence to determine the order in which the operations are performed. As * (multiplication) has higher precedence, the salary is first multiplied by 12, then 100 is added to the result of the multiplication. So for employee King (salary 24000), 12*24000 is calculated = 288000, then 100 is added to give the answer 288100.

The example on the right uses parenthesis to force the addition to be carried out first, the result of the addition is then multiplied by 12. So King has 24000+100 = 24100, this is then multiplied by 12 to give the answer 289200.

NULL Values

- In SQL, NULL is an interesting word
- To understand NULL, you have to know what NULL is and what NULL is not
- NULL is a value that is unavailable, unassigned, unknown, or inapplicable
- NULL is not the same as a zero or a space
- In SQL, a zero is a number, and a space is a character

NULL: A value that is unavailable, unassigned, unknown, or inapplicable .

NULL Values

- Sometimes, you don't know the value for a column
- In a database, you can store unknowns in your databases
- Relational databases use a placeholder called NULL or null to represent these unknown values

NULL: A value that is unavailable, unassigned, unknown, or inapplicable .

NULL Values

- If any column value in an arithmetic expression is null, the result is null or unknown

- If you try to divide by null, the result is null or unknown

- However, if you try to divide by zero, you get an error

Salaries and Commissions

LAST_NAME	JOB_ID	SALARY	COMMISSION_PCT
King	AD_PRES	24000	-
Kochhar	AD_VP	17000	-
De Haan	AD_VP	17000	-
Whalen	AD_ASST	4400	-
Higgins	AC_MGR	12000	-
Gietz	AC_ACCOU NT	8300	-
Zlotkey	SA_MAN	10500	.2
Abel	SA_REP	11000	.3

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Anatomy of a SQL Statement

22

NULL Values

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

Salaries and Commissions

LAST_NAME	JOB_ID	SALARY	COMMISSION_PCT	SALARY*COMMISSION_PCT
King	AD_PRES	24000	-	-
Kochhar	AD_VP	17000	-	-
De Haan	AD_VP	17000	-	-
Whalen	AD_ASST	4400	-	-
Higgins	AC_MGR	12000	-	-
Gietz	AC_ACCOUNT	8300	-	-
Zlotkey	SA_MAN	10500	.2	2100
Abel	SA_REP	11000	.3	3300
Taylor	SA_REP	8600	.2	1720

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In the example, a row with a null value in the commission_pct column will return a null value for the salary*commission_pct column in this query.

NULL values are displayed in APEX using the – (dash) symbol.

Aliases

- An Alias is a way of renaming a column heading in the output

- Without aliases, when the result of a SQL statement is displayed, the name of the columns displayed will be the same as the column names in the table or a name showing an arithmetic operation such as 12*(SALARY + 100)

- You probably want your output to display a name that is easier to understand, a more "friendly" name

- Column aliases let you rename columns in the output

Column alias: renames a column heading for display purposes. The original column name in the table remains unchanged.

Aliases

- There are several rules when using column aliases to format output

- A column alias:
  - Renames a column heading
  - Is useful with calculations
  - Immediately follows the column name
  - May have the optional AS keyword between the column name and alias
  - Requires double quotation marks if the alias contains spaces or special characters, or is case-sensitive

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Anatomy of a SQL Statement

Using Column Aliases

- The syntax for aliases is:

```
SELECT *  |column|expr [ AS alias], .....
FROM       table;
```

- Examples:

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

NAME	COMM
King	-
Kochhar	-
De Haan	-

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

Name	Annual Salary
King	288000
Kochhar	204000
De Haan	204000

Double quotation marks are required for aliases longer than one word or when the format of the alias is anything other than the default uppercase name (e.g., Department Name, or department, or dept.)

The first example uses the AS keyword, but has no "double quotes ", so the aliases are displayed in the default UPPER case.

The second example omits AS, but as the intended alias is more than one word, uses the double quotes.

Using the optional AS keyword makes SQL statements easier to read.

Terminology

- Key terms used in this lesson included:
  - Arithmetic expression
  - Arithmetic operator
  - Clause
  - Column
  - Column alias
  - From clause
  - NULL

Terminology

- Key terms used in this lesson included:
  - Projection
  - Select clause
  - Selection
  - Select statement
  - Statement
  - WHERE Clause
  - * (Asterisk)

Summary

- In this lesson, you should have learned how to:
  - Match projection and selection with their correct capabilities
  - Create a basic SELECT statement
  - Use the correct syntax to display all rows in a table
  - Use the correct syntax to select specific columns in a table, modify the way data is displayed, and perform calculations using arithmetic expressions and operators

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DP 1-3
Anatomy of a SQL Statement

29

Summary

- In this lesson, you should have learned how to:
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  - Demonstrate the effect null values create in arithmetic expressions
  - Construct a query using a column alias

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DP 1-3
Anatomy of a SQL Statement

30