6

Writing Explicit Cursors

Objectives

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

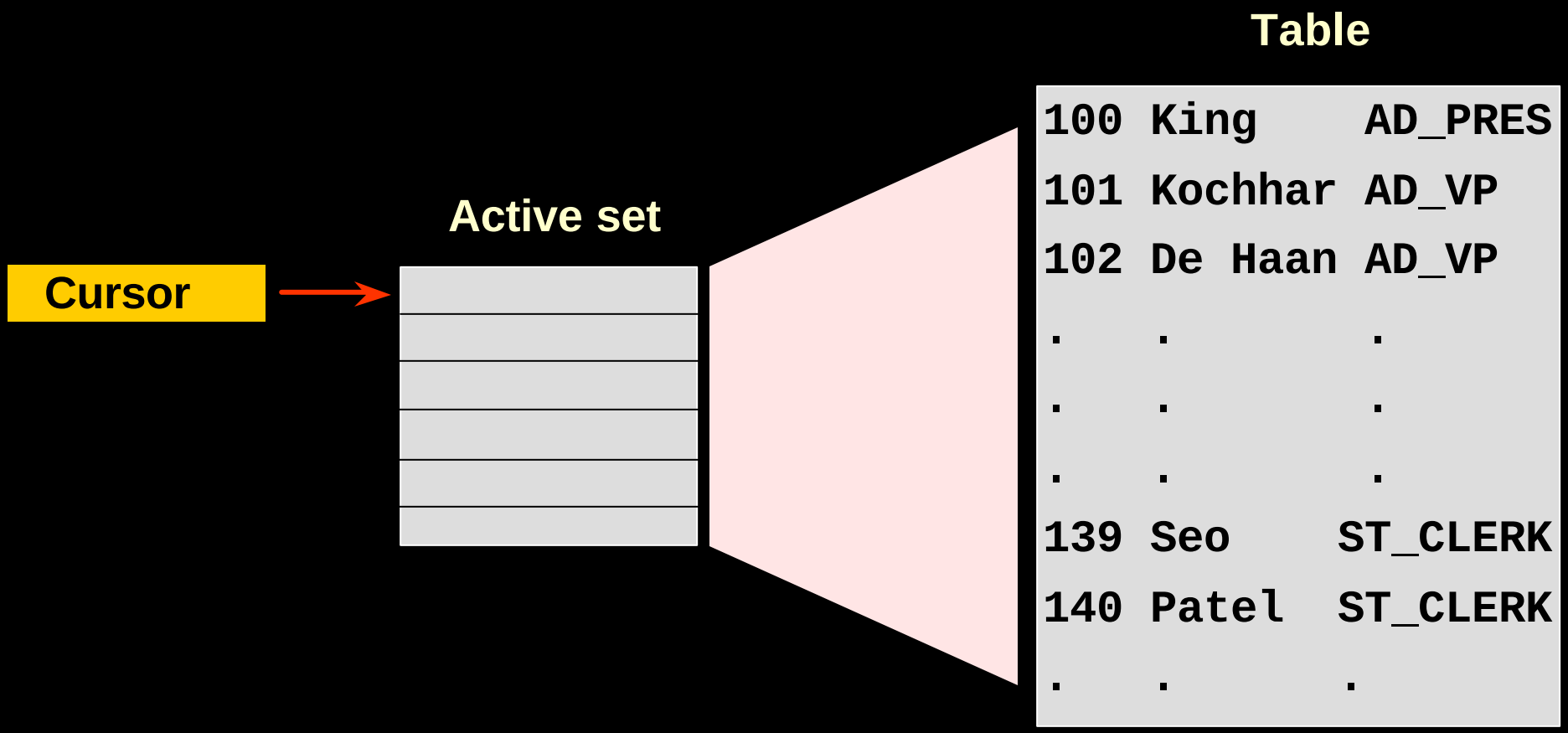
- Distinguish between an implicit and an explicit cursor
- Discuss when and why to use an explicit cursor
- Use a PL/SQL record variable
- Write a cursor FOR loop

About Cursors

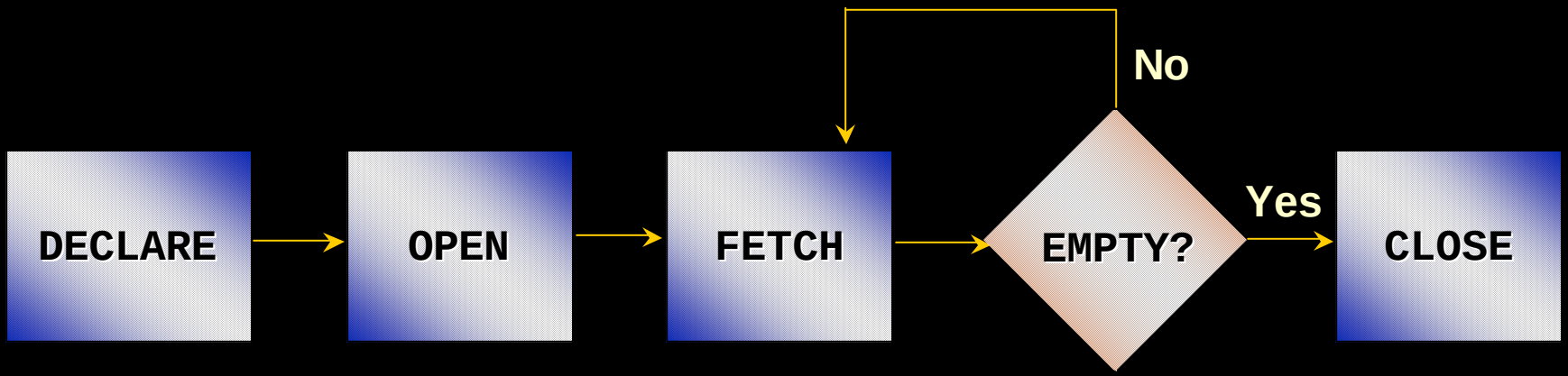
Every SQL statement executed by the Oracle Server has an individual cursor associated with it:

- Implicit cursors: Declared for all DML and PL/SQL SELECT statements
- Explicit cursors: Declared and named by the programmer

Explicit Cursor Functions



Controlling Explicit Cursors

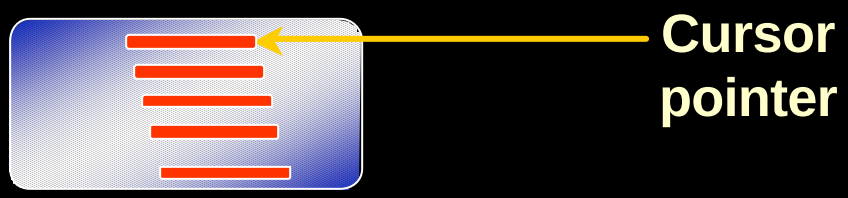


- Create a named SQL area
- Identify the active set
- Load the current row into variables
- Test for existing rows
- Return to FETCH if rows are found
- Release the active set

Controlling Explicit Cursors

1. Open the cursor
2. Fetch a row
3. Close the Cursor

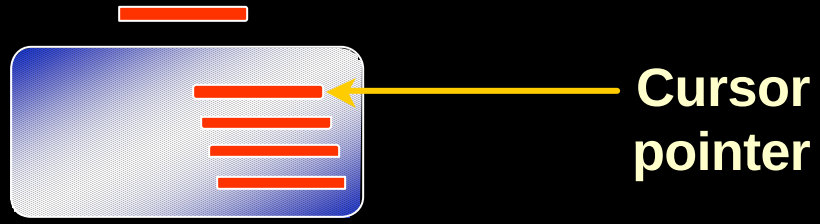
1. Open the cursor.



Controlling Explicit Cursors

1. Open the cursor
2. Fetch a row
3. Close the Cursor

2. Fetch a row using the cursor.

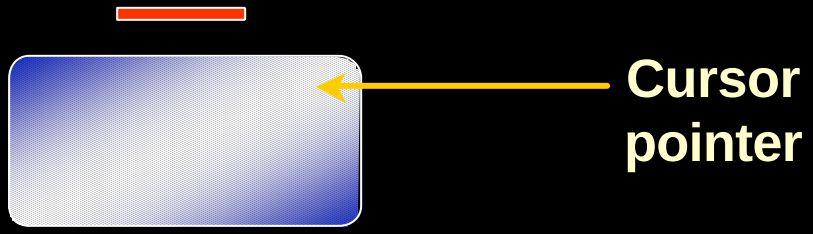


Continue until empty.

Controlling Explicit Cursors

1. Open the cursor
2. Fetch a row
3. Close the Cursor

3. Close the cursor.



Declaring the Cursor

Syntax:

```
CURSOR cursor_name IS
     select_statement;
```

- Do not include the `INTO` clause in the cursor declaration.
- If processing rows in a specific sequence is required, use the `ORDER BY` clause in the query.

Declaring the Cursor

Example:

```
DECLARE
  CURSOR emp_cursor IS
    SELECT employee_id, last_name
    FROM   employees;

  CURSOR dept_cursor IS
    SELECT *
    FROM   departments
    WHERE  location_id = 170;
BEGIN
  ...
```

Opening the Cursor

Syntax:

```
OPEN   cursor_name;
```

- Open the cursor to execute the query and identify the active set.
- If the query returns no rows, no exception is raised.
- Use cursor attributes to test the outcome after a fetch.

Fetching Data from the Cursor

Syntax:

```
FETCH cursor_name INTO  [variable1, variable2, ...]
                        | record_name];
```

- Retrieve the current row values into variables.
- Include the same number of variables.
- Match each variable to correspond to the columns positionally.
- Test to see whether the cursor contains rows.

Fetching Data from the Cursor

Example:

```
LOOP
  FETCH emp_cursor INTO v_empno,v_ename;
  EXIT WHEN ...;
  ...
    -- Process the retrieved data
  …
END LOOP;
```

Closing the Cursor

Syntax:

```
CLOSE     cursor_name;
```

- Close the cursor after completing the processing of the rows.
- Reopen the cursor, if required.
- Do not attempt to fetch data from a cursor after it has been closed.

Explicit Cursor Attributes

Obtain status information about a cursor.

Attribute	Type	Description
%ISOPEN	Boolean	Evaluates to TRUE if the cursor is open
%NOTFOUND	Boolean	Evaluates to TRUE if the most recent fetch does not return a row
%FOUND	Boolean	Evaluates to TRUE if the most recent fetch returns a row; complement of %NOTFOUND
%ROWCOUNT	Number	Evaluates to the total number of rows returned so far

The %ISOPEN Attribute

- Fetch rows only when the cursor is open.
- Use the %ISOPEN cursor attribute before performing a fetch to test whether the cursor is open.

Example:

```
IF NOT emp_cursor%ISOPEN THEN
    OPEN emp_cursor;
END IF;
LOOP
  FETCH emp_cursor...
```

Controlling Multiple Fetches

- Process several rows from an explicit cursor using a loop.
- Fetch a row with each iteration.
- Use explicit cursor attributes to test the success of each fetch.

The %NOTFOUND and %ROWCOUNT Attributes

- Use the %ROWCOUNT cursor attribute to retrieve an exact number of rows.
- Use the %NOTFOUND cursor attribute to determine when to exit the loop.

Example

```
DECLARE
      v_empno  employees.employee_id%TYPE;
      v_ename  employees.last_name%TYPE;
      CURSOR emp_cursor IS
        SELECT employee_id, last_name
        FROM   employees;
    BEGIN
      OPEN emp_cursor;
      LOOP
        FETCH emp_cursor INTO v_empno, v_ename;
        EXIT WHEN emp_cursor%ROWCOUNT > 10 OR
                          emp_cursor%NOTFOUND;
        DBMS_OUTPUT.PUT_LINE (TO_CHAR(v_empno)
                              ||'  '|| v_ename);
      END LOOP;
      CLOSE emp_cursor;
END ;
```

Cursors and Records

Process the rows of the active set by fetching values into a PL/SQL RECORD.

```
DECLARE
  CURSOR emp_cursor IS
    SELECT  employee_id, last_name
    FROM    employees;
  emp_record   emp_cursor%ROWTYPE;
BEGIN
  OPEN emp_cursor;
  LOOP
    FETCH emp_cursor INTO emp_record;
  ...
```

emp_record

employee_id	last_name
100	King

Cursor FOR Loops

Syntax:

```
FOR record_name IN cursor_name LOOP
  statement1;
  statement2;
  . . .
END LOOP;
```

- The cursor FOR loop is a shortcut to process explicit cursors.
- Implicit open, fetch, exit, and close occur.
- The record is implicitly declared.

Cursor FOR Loops

Print a list of the employees who work for the sales department.

```
DECLARE
  CURSOR emp_cursor IS
    SELECT last_name, department_id
    FROM   employees;
BEGIN
  FOR emp_record IN emp_cursor LOOP
         -- implicit open and implicit fetch occur
    IF emp_record.department_id = 80 THEN
      ...
  END LOOP; -- implicit close occurs
END;
/
```

Cursor FOR Loops Using Subqueries

No need to declare the cursor.

Example:

```
BEGIN
  FOR emp_record IN (SELECT last_name, department_id
                     FROM   employees) LOOP
        -- implicit open and implicit fetch occur
    IF emp_record.department_id = 80 THEN
      ...
  END LOOP; -- implicit close occurs
END;
```

Summary

In this lesson you should have learned to:

- Distinguish cursor types:
  - Implicit cursors: used for all `DML` statements and single-row queries
  - Explicit cursors: used for queries of zero, one, or more rows
- Manipulate explicit cursors
- Evaluate the cursor status by using cursor attributes
- Use cursor `FOR` loops

Practice 6

1. Run the command in the script `lab06_1.sql` to create a new table for storing the salaries of the employees.

```
CREATE TABLE     top_dogs
( salary         NUMBER(8,2));
```

2. Create a PL/SQL block that determines the top employees with respect to salaries.
   a. Accept a number *n* from the user where *n* represents the number of top *n* earners from the `EMPLOYEES` table. For example, to view the top five earners, enter 5.

      Note: Use the `DEFINE` command to provide the value for *n*. Pass the value to the PL/SQL block through a *i*SQL*Plus substitution variable.

   b. In a loop use the *i*SQL*Plus substitution parameter created in step 1 and gather the salaries of the top *n* people from the `EMPLOYEES` table. There should be no duplication in the salaries. If two employees earn the same salary, the salary should be picked up only once.

   c. Store the salaries in the `TOP_DOGS` table.

   d. Test a variety of special cases, such as *n* = 0 or where *n* is greater than the number of employees in the `EMPLOYEES` table. Empty the `TOP_DOGS` table after each test. The output shown represents the five highest salaries in the `EMPLOYEES` table.

SALARY
24000
17000
14000
13500
13000

3. Create a PL/SQL block that does the following:
   a. Use the `DEFINE` command to provide the department ID. Pass the value to the PL/SQL block through a *i*SQL*Plus substitution variable.

   b. In a PL/SQL block, retrieve the last name, salary, and `MANAGER ID` of the employees working in that department.

   c. If the salary of the employee is less than 5000 and if the manager ID is either 101 or 124, display the message `<<last_name>> Due for a raise`. Otherwise, display the message `<<last_name>> Not due for a raise`.

Note: `SET ECHO OFF` to avoid displaying the PL/SQL code every time you execute the script.

Practice 6 (continued)

d. Test the PL/SQL block for the following cases:

Department ID	Message
10	Whalen Due for a raise
20	Hartstein Not Due for a raise Fay Not Due for a raise
50	Weiss Not Due for a raise Fripp Due for a raise Kaufling Due for a raise Vollman Due for a raise Mourgas Due for a raise . . . . . .
80	Russel Not Due for a raise Partners Not Due for a raise Errazuriz Not Due for a raise Cambrault Not Due for a raise . . . . . .