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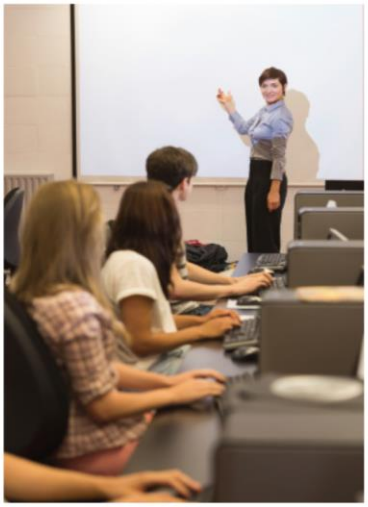
Database Programming with PL/SQL

5-6

Using Multiple Cursors



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Objectives

- This lesson covers the following objectives:
  - Explain the need for using multiple cursors to produce multi-level reports
  - Create PL/SQL code to declare and manipulate multiple cursors within nested loops
  - Create PL/SQL code to declare and manipulate multiple cursors using parameters

Purpose

- In real-life programs you often need to declare and use two or more cursors in the same PL/SQL block
- Often these cursors are related to each other by parameters
- One common example is the need for multi-level reports in which each level of the report uses rows from a different cursor
- This lesson does not introduce new concepts or syntax
- It shows more powerful uses for the concepts and syntax that you already know

A Sample Problem Statement

- You need to produce a report that lists each department as a sub-heading, immediately followed by a listing of the employees in that department, followed by the next department, and so on
- You need two cursors, one for each of the two tables
- The cursor based on EMPLOYEES is opened several times, once for each department

Problem Solution: Step 1

- Declare two cursors, one for each table, plus associated record structures
- Why is cursor cur_emp declared with a parameter?

```
DECLARE
 CURSOR cur_dept IS
  SELECT department_id, department_name
   FROM departments
   ORDER BY department_name;
 CURSOR cur_emp (p_deptid NUMBER) IS
  SELECT first_name, last_name
   FROM employees
   WHERE department_id = p_deptid
   ORDER BY last_name;
 v_deptrec  cur_dept%ROWTYPE;
 v_emprec  cur_emp%ROWTYPE;
```

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Answer: Because we will OPEN C_EMP several times (once for each department) and it must fetch a different set of rows each time.

Problem Solution: Step 2

- Open the cur_dept cursor and fetch and display the DEPARTMENTS rows in the usual way

```
DECLARE
 CURSOR cur_dept IS .....;
 CURSOR cur_emp (p_deptid NUMBER) IS .....;
 v_deptrec  cur_dept%ROWTYPE;
 v_emprec  cur_emp%ROWTYPE;
BEGIN
 OPEN cur_dept;
 LOOP
  FETCH cur_dept INTO v_deptrec;
  EXIT WHEN cur_dept%NOTFOUND;
  DBMS_OUTPUT.PUT_LINE(v_deptrec.department_name);
 END LOOP;
 CLOSE cur_dept;
END;
```

Problem Solution: Step 3

- After each DEPARTMENTS row has been fetched and displayed, you need to fetch and display the EMPLOYEES in that department
- To do this, you open the EMPLOYEES cursor, fetch and display its rows in a nested loop, and close the cursor
- Then, you do the same for the next DEPARTMENTS row
- And so on
- The next slide shows the code for this

Problem Solution

```
DECLARE
 CURSOR cur_dept IS .....;
 CURSOR cur_emp (p_deptid NUMBER) IS .....;
 v_deptrec  cur_dept%ROWTYPE;
 v_emprec  cur_emp%ROWTYPE;
BEGIN
 OPEN cur_dept;
 LOOP
  FETCH cur_dept INTO v_deptrec;
  EXIT WHEN cur_dept%NOTFOUND;
  DBMS_OUTPUT.PUT_LINE(v_deptrec.department_name);
  OPEN cur_emp (v_deptrec.department_id);
  LOOP
   FETCH cur_emp INTO v_emprec;
   EXIT WHEN cur_emp%NOTFOUND;
   DBMS_OUTPUT.PUT_LINE(v_emprec.last_name || ' ' ||
      v_emprec.first_name);
  END LOOP;
  CLOSE cur_emp;
 END LOOP;
 CLOSE cur_dept;
END;
```

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The inner CUR_EMP loop executes once for each row fetched by the CUR_DEPT cursor and fetches a different subset of EMPLOYEES each time due to the parameter p_deptid.

A Second Example

- You need to produce a report that lists each location in which your departments are situated, followed by the departments in that location
- Again, you need two cursors, one for each of the two tables
- The cursor based on DEPARTMENTS will be opened several times, once for each location
- The next slide shows the code needed to produce this report

In many situations involving multilevel reports, the tables will usually be related to each other by a foreign key.

A Second Example

```
DECLARE
 CURSOR cur_loc IS SELECT * FROM locations;
 CURSOR cur_dept (p_locid NUMBER) IS
  SELECT * FROM departments WHERE location_id = p_locid;
 v_locrec  cur_loc%ROWTYPE;
 v_deptrec cur_dept%ROWTYPE;
BEGIN
 OPEN cur_loc;
 LOOP
  FETCH cur_loc INTO v_locrec;
  EXIT WHEN cur_loc%NOTFOUND;
  DBMS_OUTPUT.PUT_LINE(v_locrec.city);
  OPEN cur_dept (v_locrec.location_id);
  LOOP
   FETCH cur_dept INTO v_deptrec;
   EXIT WHEN cur_dept%NOTFOUND;
   DBMS_OUTPUT.PUT_LINE(v_deptrec.department_name);
  END LOOP;
  CLOSE cur_dept;
 END LOOP;
 CLOSE cur_loc;
END;
```


The inner CUR_DEPT loop executes once for each row fetched by the CUR_LOC cursor and, due to the parameter p_locid, fetches a different subset of DEPARTMENTS each time.

Using FOR Loops with Multiple Cursors

- You can use FOR loops (and other cursor techniques, such as FOR UPDATE) with multiple cursors, just as you can with single cursors

```
DECLARE
 CURSOR cur_loc IS SELECT * FROM locations;
 CURSOR cur_dept (p_locid NUMBER) IS
  SELECT * FROM departments WHERE location_id = p_locid;
BEGIN
 FOR v_locrec IN cur_loc
 LOOP
  DBMS_OUTPUT.PUT_LINE(v_locrec.city);
  FOR v_deptrec IN cur_dept (v_locrec.location_id)
  LOOP
   DBMS_OUTPUT.PUT_LINE(v_deptrec.department_name);
  END LOOP;
 END LOOP;
END;
```

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This code is functionally identical to that in the previous slide, but is more compact and easier to maintain.

A Final Example

- Which employees will receive a salary increase by running the code below?

```
DECLARE
 CURSOR cur_dept IS SELECT * FROM my_departments;
 CURSOR cur_emp (p_dept_id NUMBER) IS
  SELECT * FROM my_employees WHERE department_id = p_dept_id
   FOR UPDATE NOWAIT;
BEGIN
 FOR v_deptrec IN cur_dept LOOP
  DBMS_OUTPUT.PUT_LINE(v_deptrec.department_name);
  FOR v_emprec IN cur_emp (v_deptrec.department_id) LOOP
   DBMS_OUTPUT.PUT_LINE(v_emprec.last_name);
   IF v_deptrec.location_id = 1700 AND v_emprec.salary < 10000
    THEN UPDATE my_employees
     SET salary = salary * 1.1
     WHERE CURRENT OF cur_emp;
   END IF;
  END LOOP;
 END LOOP;
END;
```


Answer: employees in department 1700 who currently earn less than 10000.

Summary

- In this lesson, you should have learned how to:
  - Explain the need for using multiple cursors to produce multi-level reports
  - Create PL/SQL code to declare and manipulate multiple cursors within nested loops
  - Create PL/SQL code to declare and manipulate multiple cursors using parameters


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