

PL/SQL - CURSORS

Oracle creates a memory area, known as context area, for processing an SQL statement, which contains all information needed for processing the statement, for example, number of rows processed etc.

A cursor is a pointer to this context area. PL/SQL controls the context area through a cursor. A cursor holds the rows (one or more) returned by a SQL statement. The set of rows the cursor holds is referred to as the **active set**.

You can name a cursor so that it could be referred to in a program to fetch and process the rows returned by the SQL statement, one at a time. There are two types of cursors:

- Implicit cursors
- Explicit cursors

Implicit Cursors

Implicit cursors are automatically created by Oracle whenever an SQL statement is executed, when there is no explicit cursor for the statement. Programmers cannot control the implicit cursors and the information in it.

Whenever a DML statement (INSERT, UPDATE and DELETE) is issued, an implicit cursor is associated with this statement. For INSERT operations, the cursor holds the data that need to be inserted. For UPDATE and DELETE operations, the cursor identifies the rows that would be affected.

In PL/SQL, you can refer to the most recent implicit cursor as the **SQL cursor**, which always has the attributes like %FOUND, %ISOPEN, %NOTFOUND, and %ROWCOUNT. The SQL cursor has additional attributes, %BULK_ROWCOUNT and %BULK_EXCEPTIONS, designed for use with the FORALL statement. The following table provides the description of the most used attributes:

Attribute	Description
%FOUND	Returns TRUE if an INSERT, UPDATE, or DELETE statement affected one or more rows or a SELECT INTO statement returned one or more rows. Otherwise, it returns FALSE.
%NOTFOUND	The logical opposite of %FOUND. It returns TRUE if an INSERT, UPDATE, or DELETE statement affected no rows, or a SELECT INTO statement returned no rows. Otherwise, it returns FALSE.
%ISOPEN	Always returns FALSE for implicit cursors, because Oracle closes the SQL cursor automatically after executing its associated SQL statement.
%ROWCOUNT	Returns the number of rows affected by an INSERT, UPDATE, or DELETE statement, or returned by a SELECT INTO statement.

Any SQL cursor attribute will be accessed as **sql%attribute_name** as shown below in the the example.

Example:

We will be using the CUSTOMERS table we had created and used in the previous chapters.

```
Select * from customers;
```

ID	NAME	AGE	ADDRESS	SALARY
1	Ramesh	32	Ahmedabad	2000.00
2	Khilan	25	Delhi	1500.00
3	kaushik	23	Kota	2000.00
4	Chaitali	25	Mumbai	6500.00
5	Hardik	27	Bhopal	8500.00
6	Komal	22	MP	4500.00

The following program would update the table and increase salary of each customer by 500 and use the SQL%ROWCOUNT attribute to determine the number of rows affected:

```
DECLARE
    total_rows number(2);
BEGIN
    UPDATE customers
    SET salary = salary + 500;
    IF sql%notfound THEN
        dbms_output.put_line('no customers selected');
    ELSIF sql%found THEN
        total_rows := sql%rowcount;
        dbms_output.put_line( total_rows || ' customers selected ');
    END IF;
END;
```

When the above code is executed at SQL prompt, it produces the following result:

```
6 customers selected
```

```
PL/SQL procedure successfully completed.
```

If you check the records in customers table, you will find that the rows have been updated:

```
Select * from customers;
```

ID	NAME	AGE	ADDRESS	SALARY
1	Ramesh	32	Ahmedabad	2500.00
2	Khilan	25	Delhi	2000.00
3	kaushik	23	Kota	2500.00
4	Chaitali	25	Mumbai	7000.00
5	Hardik	27	Bhopal	9000.00
6	Komal	22	MP	5000.00

Explicit Cursors

Explicit cursors are programmer defined cursors for gaining more control over the **context area**. An explicit cursor should be defined in the declaration section of the PL/SQL Block. It is created on a SELECT Statement which returns more than one row.

The syntax for creating an explicit cursor is :

```
CURSOR cursor_name IS select_statement;
```

Working with an explicit cursor involves four steps:

- Declaring the cursor for initializing in the memory

- Opening the cursor for allocating memory
- Fetching the cursor for retrieving data
- Closing the cursor to release allocated memory

Declaring the Cursor

Declaring the cursor defines the cursor with a name and the associated SELECT statement. For example:

```
CURSOR c_customers IS
  SELECT id, name, address FROM customers;
```

Opening the Cursor

Opening the cursor allocates memory for the cursor, and makes it ready for fetching the rows returned by the SQL statement into it. For example, we will open above defined cursor as follows:

```
OPEN c_customers;
```

Fetching the Cursor

Fetching the cursor involves accessing one row at a time. For example we will fetch rows from the above open cursor as follows:

```
FETCH c_customers INTO c_id, c_name, c_addr;
```

Closing the Cursor

Closing the cursor means releasing the allocated memory. For example, we will close above opened cursor as follows:

```
CLOSE c_customers;
```

Example:

Following is a complete example to illustrate the concepts of explicit cursors:

```
DECLARE
  c_id customers.id%type;
  c_name customers.name%type;
  c_addr customers.address%type;
  CURSOR c_customers is
    SELECT id, name, address FROM customers;
BEGIN
  OPEN c_customers;
  LOOP
    FETCH c_customers INTO c_id, c_name, c_addr;
    dbms_output.put_line(c_id || ' ' || c_name || ' ' || c_addr);
    EXIT WHEN c_customers%notfound;
  END LOOP;
  CLOSE c_customers;
END;
```

When the above code is executed at SQL prompt, it produces the following result:

```
1 Ramesh Ahmedabad
2 Khilan Delhi
3 kaushik Kota
4 Chaitali Mumbai
```

5 Hardik Bhopal
6 Komal MP

PL/SQL procedure successfully completed.