13

More Package Concepts

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Objectives

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

- Write packages that use the overloading feature
- Describe errors with mutually referential subprograms
- Initialize variables with a one-time-only procedure
- Identify persistent states

Overloading

- Enables you to use the same name for different subprograms inside a PL/SQL block, a subprogram, or a package
- Requires the formal parameters of the subprograms to differ in number, order, or data type family
- Enables you to build more flexibility because a user or application is not restricted by the specific data type or number of formal parameters

Note: Only local or packaged subprograms can be overloaded. You cannot overload stand-alone subprograms.

Overloading: Example

over_pack.sql

```
CREATE OR REPLACE PACKAGE over_pack
IS
  PROCEDURE add_dept
   (p_deptno IN departments.department_id%TYPE,
    p_name IN departments.department_name%TYPE
                                 DEFAULT 'unknown',
    p_loc IN departments.location_id%TYPE DEFAULT 0);
  PROCEDURE add_dept
   (p_name IN departments.department_name%TYPE
                                 DEFAULT 'unknown',
    p_loc  IN departments.location_id%TYPE DEFAULT 0);
END over_pack;
/
```

```
Package created.
```

Overloading: Example

over_pack_body.sql

```
CREATE OR REPLACE PACKAGE BODY over_pack  IS
 PROCEDURE add_dept
 (p_deptno IN departments.department_id%TYPE,
  p_name IN departments.department_name%TYPE DEFAULT 'unknown',
  p_loc  IN departments.location_id%TYPE DEFAULT 0)
 IS
 BEGIN
  INSERT INTO departments (department_id,
                           department_name, location_id)
  VALUES  (p_deptno, p_name, p_loc);
 END add_dept;
 PROCEDURE add_dept
 (p_name IN departments.department_name%TYPE DEFAULT 'unknown',
  p_loc  IN departments.location_id%TYPE DEFAULT 0)
 IS
 BEGIN
  INSERT INTO departments (department_id,
                           department_name, location_id)
  VALUES  (departments_seq.NEXTVAL, p_name, p_loc);
 END add_dept;
END over_pack;
/
```

Overloading: Example

- Most built-in functions are overloaded.
- For example, see the `TO_CHAR` function of the `STANDARD` package.

```
FUNCTION TO_CHAR (p1 DATE) RETURN VARCHAR2;
FUNCTION TO_CHAR (p2 NUMBER) RETURN VARCHAR2;
FUNCTION TO_CHAR (p1 DATE, P2 VARCHAR2) RETURN VARCHAR2;
FUNCTION TO_CHAR (p1 NUMBER, P2 VARCHAR2) RETURN VARCHAR2;
```

- If you redeclare a built-in subprogram in a PL/SQL program, your local declaration overrides the global declaration.

Using Forward Declarations

You must declare identifiers before referencing them.

```
CREATE OR REPLACE PACKAGE BODY forward_pack
IS
  PROCEDURE award_bonus(. . .)
  IS
  BEGIN
   calc_rating(. . .);        --illegal reference

  END;

  PROCEDURE calc_rating(. . .)
  IS
  BEGIN
    ...
  END;

END forward_pack;
/
```

Using Forward Declarations

```
CREATE OR REPLACE PACKAGE BODY forward_pack
IS

 PROCEDURE calc_rating(. . .);    -- forward declaration

 PROCEDURE award_bonus(. . .)
 IS                               -- subprograms defined
 BEGIN                            -- in alphabetical order
  calc_rating(. . .);
 . . .
 END;

 PROCEDURE calc_rating(. . .)
 IS
 BEGIN
  . . .
 END;

END forward_pack;
/
```

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Creating a One-Time-Only Procedure

```
CREATE OR REPLACE PACKAGE taxes
IS
    tax   NUMBER;
  ...  -- declare all public procedures/functions
END  taxes;
/
```

```
CREATE OR REPLACE PACKAGE BODY taxes
IS
  ... -- declare all private variables
  ... -- define public/private procedures/functions
BEGIN
   SELECT   rate_value
   INTO     tax
   FROM     tax_rates
   WHERE    rate_name = 'TAX';
END taxes;
/
```

Restrictions on Package Functions Used in SQL

A function called from:

- A query or DML statement can not end the current transaction, create or roll back to a savepoint, or `ALTER` the system or session.
- A query statement or a parallelized DML statement can not execute a DML statement or modify the database.
- A DML statement can not read or modify the particular table being modified by that DML statement.

Note: Calls to subprograms that break the above restrictions are not allowed.

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User Defined Package: `taxes_pack`

```
CREATE OR REPLACE PACKAGE taxes_pack
IS
   FUNCTION tax (p_value IN NUMBER) RETURN NUMBER;
END taxes_pack;
/
```

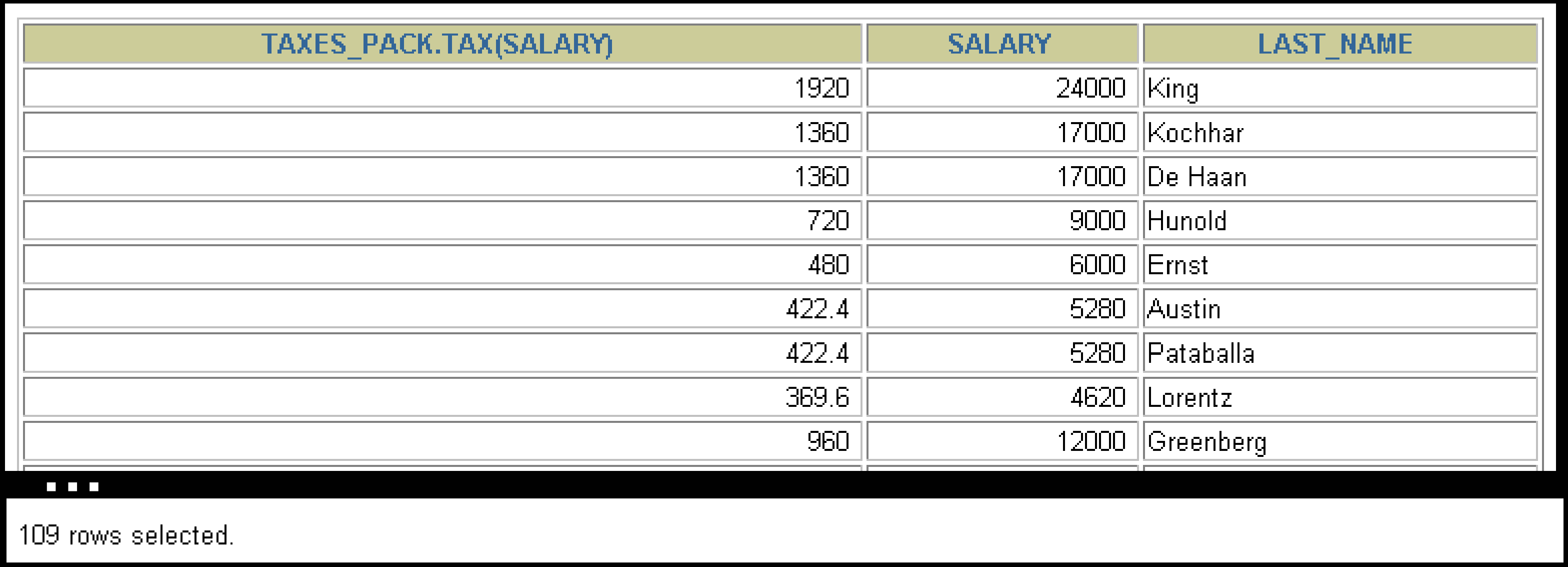
```
Package created.
```

```
CREATE OR REPLACE PACKAGE BODY taxes_pack
IS
   FUNCTION tax (p_value IN NUMBER) RETURN NUMBER
   IS
    v_rate NUMBER := 0.08;
   BEGIN
     RETURN (p_value * v_rate);
   END tax;
END taxes_pack;
/
```

```
Package body created.
```

Invoking a User-Defined Package Function from a SQL Statement

```
SELECT taxes_pack.tax(salary), salary, last_name
FROM   employees;
```



TAXES_PACK.TAX(SALARY)	SALARY	LAST_NAME
1920	24000	King
1360	17000	Kochhar
1360	17000	De Haan
720	9000	Hunold
480	6000	Ernst
422.4	5280	Austin
422.4	5280	Pataballa
369.6	4620	Lorentz
960	12000	Greenberg

...

```
109 rows selected.
```

Persistent State of Package Variables: Example

```
CREATE OR REPLACE PACKAGE comm_package IS
  g_comm  NUMBER := 10;              --initialized to 10
  PROCEDURE reset_comm (p_comm   IN   NUMBER);
END comm_package;
/
```

```
CREATE OR REPLACE PACKAGE BODY comm_package IS
   FUNCTION  validate_comm (p_comm  IN  NUMBER)
             RETURN BOOLEAN
   IS v_max_comm    NUMBER;
   BEGIN
    ...      -- validates commission to be less than maximum
             --  commission in the table
   END validate_comm;
   PROCEDURE  reset_comm (p_comm   IN  NUMBER)
   IS BEGIN
     ...     -- calls validate_comm with specified value
   END reset_comm;
END comm_package;
/
```

Persistent State of Package Variables

Time	Scott	Jones
9:00	`EXECUTE comm_package.reset_comm (0.25)` max_comm=0.4 > 0.25 g_comm = 0.25	
9:30		`INSERT INTO employees (last_name, commission_pct) VALUES ('Madonna', 0.8);` max_comm=0.8
9:35		`EXECUTE comm_package.reset_comm(0.5)` max_comm=0.8 > 0.5 g_comm = 0.5

Persistent State of Package Variables

Time	Scott	Jones

9:00	`EXECUTE comm_package.reset_comm (0.25)`
	max_comm=0.4 > 0.25
	g_comm = 0.25	

9:30		`INSERT INTO employees (last_name, commission_pct) VALUES ('Madonna', 0.8);`
		max_comm=0.8

9:35		`EXECUTE comm_package.reset_comm(0.5)`
		max_comm=0.8 > 0.5
		g_comm = 0.5

10:00	`EXECUTE comm_package.reset_comm (0.6)`
	max_comm=0.4 < 0.6 INVALID	

11:00		`ROLLBACK;`
11:01		`EXIT`

Persistent State of Package Variables

Time	Scott	Jones
9:00	EXECUTE comm_package.reset_comm (0.25) max_comm=0.4 > 0.25 g_comm = 0.25	

9:30		INSERT INTO employees
		(last_name, commission_pct)
		VALUES ('Madonna', 0.8);
		max_comm=0.8

9:35		EXECUTE
		comm_package.reset_comm(0.5)
		max_comm=0.8 > 0.5
		g_comm = 0.5

10:00	EXECUTE comm_package.reset_comm (0.6) max_comm=0.4 < 0.6 INVALID	
11:00		ROLLBACK;
11:01		EXIT
11:45		Logged In again. g_comm = 10, max_comm=0.4
12:00	VALID →	EXECUTE comm_package.reset_comm(0.25)

Controlling the Persistent State of a Package Cursor

Example:

```
CREATE OR REPLACE PACKAGE pack_cur
IS
 CURSOR c1 IS  SELECT employee_id
               FROM   employees
               ORDER BY employee_id DESC;
 PROCEDURE proc1_3rows;
 PROCEDURE proc4_6rows;
END pack_cur;
/
```

```
Package created.
```

Controlling the Persistent State of a Package Cursor

```
CREATE OR REPLACE PACKAGE BODY pack_cur  IS
  v_empno NUMBER;
  PROCEDURE proc1_3rows IS
  BEGIN
    OPEN c1;
    LOOP
     FETCH c1 INTO v_empno;
     DBMS_OUTPUT.PUT_LINE('Id :' ||(v_empno));
     EXIT WHEN c1%ROWCOUNT >= 3;
    END LOOP;
  END proc1_3rows;
  PROCEDURE proc4_6rows IS
  BEGIN
    LOOP
     FETCH c1 INTO v_empno;
     DBMS_OUTPUT.PUT_LINE('Id :' ||(v_empno));
     EXIT WHEN c1%ROWCOUNT >= 6;
    END LOOP;
    CLOSE c1;
  END proc4_6rows;
END pack_cur;
/
```

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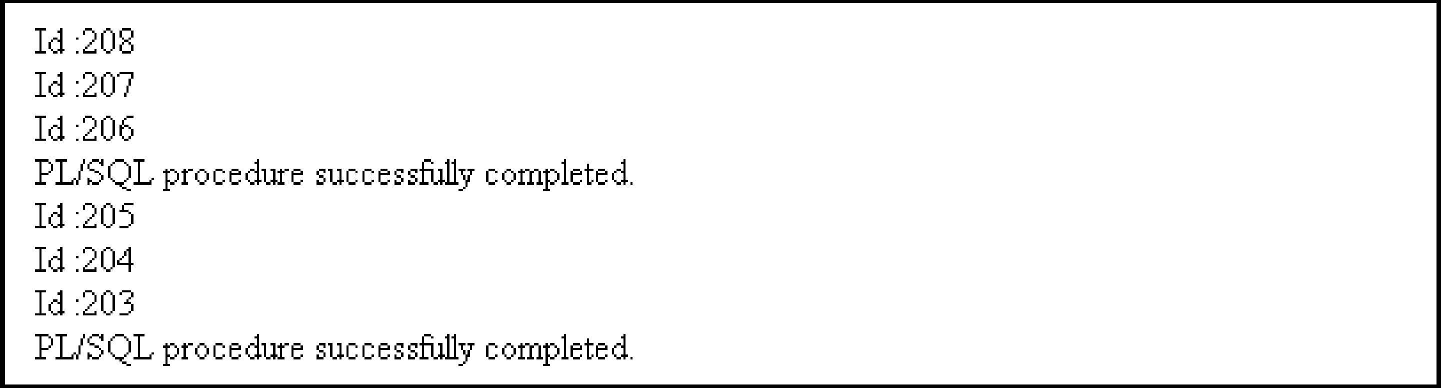
Executing `PACK_CUR`

```
SET SERVEROUTPUT ON
EXECUTE pack_cur.proc1_3rows
EXECUTE pack_cur.proc4_6rows
```



```
Id :208
Id :207
Id :206
PL/SQL procedure successfully completed.
Id :205
Id :204
Id :203
PL/SQL procedure successfully completed.
```

PL/SQL Tables and Records in Packages

```
CREATE OR REPLACE PACKAGE emp_package IS
  TYPE emp_table_type IS TABLE OF employees%ROWTYPE
     INDEX BY BINARY_INTEGER;
  PROCEDURE read_emp_table
              (p_emp_table OUT emp_table_type);
END emp_package;
/
```

```
CREATE OR REPLACE PACKAGE BODY emp_package IS
  PROCEDURE read_emp_table
              (p_emp_table OUT emp_table_type) IS
  i BINARY_INTEGER := 0;
  BEGIN
    FOR emp_record IN (SELECT * FROM employees)
    LOOP
      p_emp_table(i) := emp_record;
      i:= i+1;
    END LOOP;
  END read_emp_table;
END emp_package;
/
```

Summary

In this lesson, you should have learned how to:

- Overload subprograms
- Use forward referencing
- Use one-time-only procedures
- Describe the purity level of package functions
- Identify the persistent state of packaged objects

Practice 13 Overview

This practice covers the following topics:

- Using overloaded subprograms
- Creating a one-time-only procedure

Latihan bab 28 – More Package Concepts

1. Buka terminal SQL Plus, kemudian login ke database oracle menggunakan user **HR.**
2. Buat satu package dengan nama **`pegawai`** yang berisi:
    a. Procedure **`cari_pegawai`** yang berfungsi untuk menampilkan nama pegawai (first nama dan last name), nama departemen, dan gaji. Procedure ini menerima parameter:
        - Nomor departemen,

    b. Procedure **`cari_pegawai`** yang berfungsi sama seperti procedure pada soal 2.a, tetapi parameter yang diterima berbeda. Parameternya yaitu:
        - Nama akhir dari pegawai (case insensitive)

3. Coba dua panggil dua prosedur diatas.