10 Creating Functions

Objectives

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

- Describe the uses of functions
- Create stored functions
- Invoke a function
- Remove a function
- Differentiate between a procedure and a function

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Overview of Stored Functions

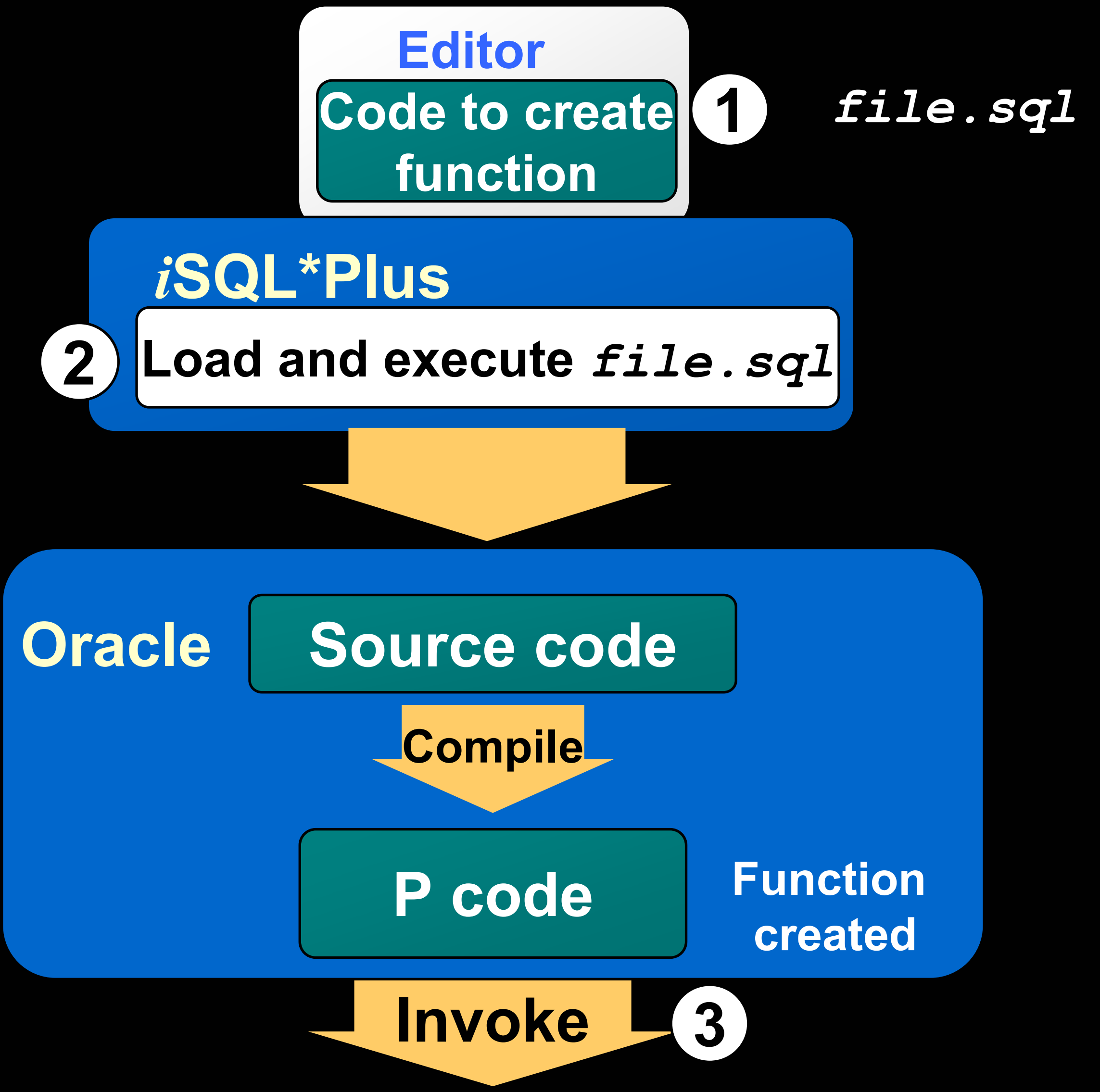
- A function is a named PL/SQL block that returns a value.
- A function can be stored in the database as a schema object for repeated execution.
- A function is called as part of an expression.

Syntax for Creating Functions

```
CREATE [OR REPLACE] FUNCTION function_name
 [(parameter1 [mode1] datatype1,
  parameter2 [mode2] datatype2,
  . . .)]
RETURN datatype
IS|AS
PL/SQL Block;
```

The PL/SQL block must have at least one `RETURN` statement.

Creating a Function



Creating a Stored Function by Using *i*SQL*Plus

1. Enter the text of the `CREATE FUNCTION` statement in an editor and save it as a SQL script file.
2. Run the script file to store the source code and compile the function.
3. Use `SHOW ERRORS` to see compilation errors.
4. When successfully compiled, invoke the function.

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Creating a Stored Function by Using *i*SQL*Plus: Example

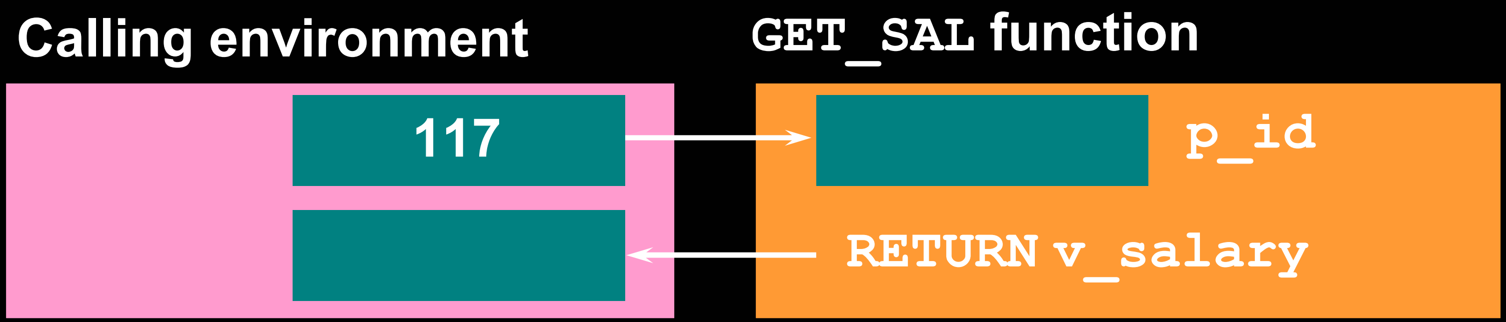
get_salary.sql

```
CREATE OR REPLACE FUNCTION get_sal
      (p_id  IN employees.employee_id%TYPE)
      RETURN NUMBER
IS
      v_salary employees.salary%TYPE :=0;
BEGIN
      SELECT salary
      INTO   v_salary
      FROM   employees
      WHERE  employee_id = p_id;
     RETURN v_salary;
END get_sal;
/
```

Executing Functions

- Invoke a function as part of a PL/SQL expression.
- Create a variable to hold the returned value.
- Execute the function. The variable will be populated by the value returned through a `RETURN` statement.

Executing Functions: Example



1. Load and run the `get_salary.sql` file to create the function

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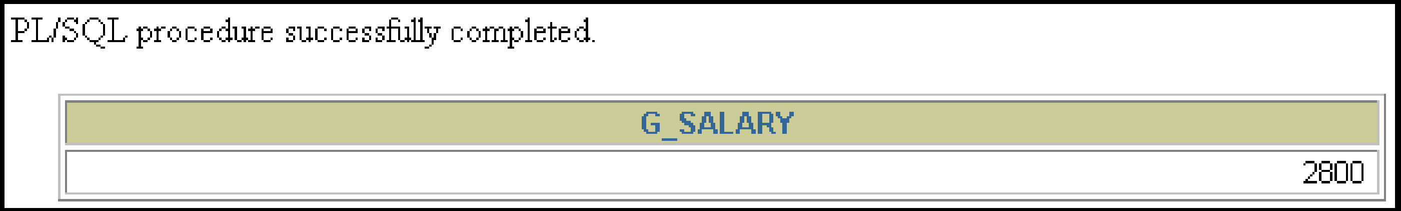
```
VARIABLE g_salary NUMBER

EXECUTE :g_salary := get_sal(117)

PRINT g_salary
```



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

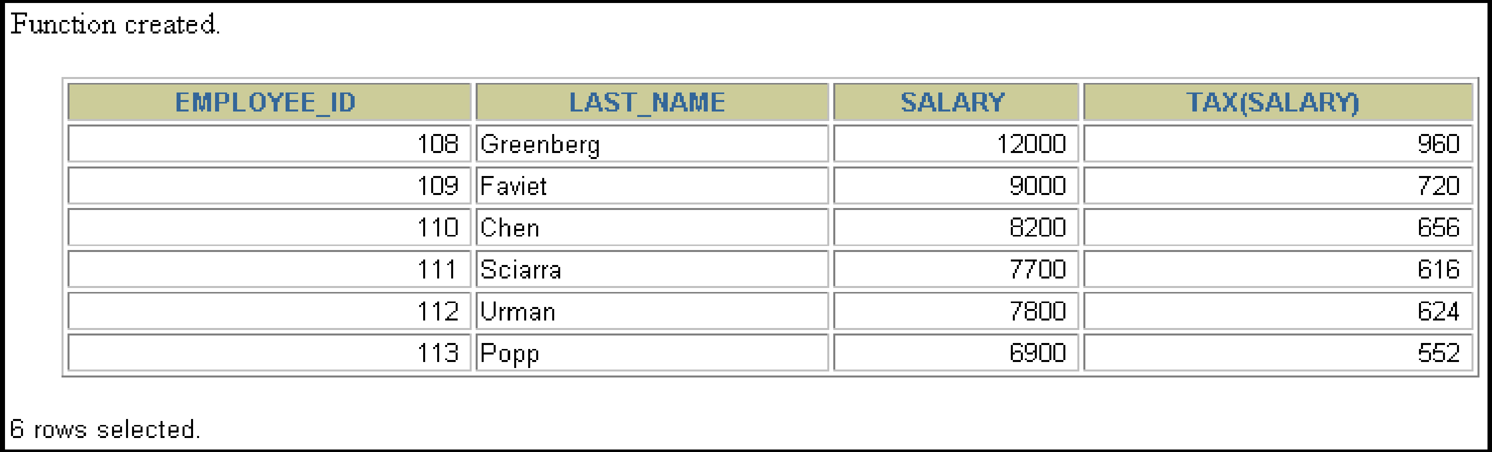
G_SALARY
2800

Advantages of User-Defined Functions in SQL Expressions

- Extend SQL where activities are too complex, too awkward, or unavailable with SQL
- Can increase efficiency when used in the `WHERE` clause to filter data, as opposed to filtering the data in the application
- Can manipulate character strings

Invoking Functions in SQL Expressions: Example

```
CREATE OR REPLACE FUNCTION tax(p_value IN NUMBER)
 RETURN NUMBER IS
BEGIN
   RETURN (p_value * 0.08);
END tax;
/
SELECT employee_id, last_name, salary, tax(salary)
FROM   employees
WHERE  department_id = 100;
```



Function created.

EMPLOYEE_ID	LAST_NAME	SALARY	TAX(SALARY)
108	Greenberg	12000	960
109	Faviet	9000	720
110	Chen	8200	656
111	Sciarra	7700	616
112	Urman	7800	624
113	Popp	6900	552

6 rows selected.

Locations to Call User-Defined Functions

- Select list of a `SELECT` command
- Condition of the `WHERE` and `HAVING` clauses
- `CONNECT BY`, `START WITH`, `ORDER BY`, and `GROUP BY` clauses
- `VALUES` clause of the `INSERT` command
- `SET` clause of the `UPDATE` command

Restrictions on Calling Functions from SQL Expressions

To be callable from SQL expressions, a user-defined function must:

- Be a stored function
- Accept only `IN` parameters
- Accept only valid SQL data types, not PL/SQL specific types, as parameters
- Return data types that are valid SQL data types, not PL/SQL specific types

Restrictions on Calling Functions from SQL Expressions

- Functions called from SQL expressions cannot contain DML statements.
- Functions called from `UPDATE/DELETE` statements on a table T cannot contain DML on the same table T.
- Functions called from an `UPDATE` or a `DELETE` statement on a table T cannot query the same table.
- Functions called from SQL statements cannot contain statements that end the transactions.
- Calls to subprograms that break the previous restriction are not allowed in the function.

Restrictions on Calling from SQL

```
CREATE OR REPLACE FUNCTION dml_call_sql (p_sal NUMBER)
   RETURN NUMBER IS
BEGIN
   INSERT INTO employees(employee_id, last_name, email,
                         hire_date, job_id, salary)
         VALUES(1, 'employee 1', 'emp1@company.com',
                SYSDATE, 'SA_MAN', 1000);
   RETURN (p_sal + 100);
END;
/
```

```
Function created.
```

```
UPDATE employees SET salary = dml_call_sql(2000)
 WHERE employee_id = 170;
```

```
UPDATE employees SET salary = dml_call_sql(2000)
                              *
ERROR at line 1:
ORA-04091: table PLSQL.EMPLOYEES is mutating, trigger/function may not see it
ORA-06512: at "PLSQL.DML_CALL_SQL", line 4
```

Removing Functions

Drop a stored function.

Syntax:

```
DROP FUNCTION function_name
```

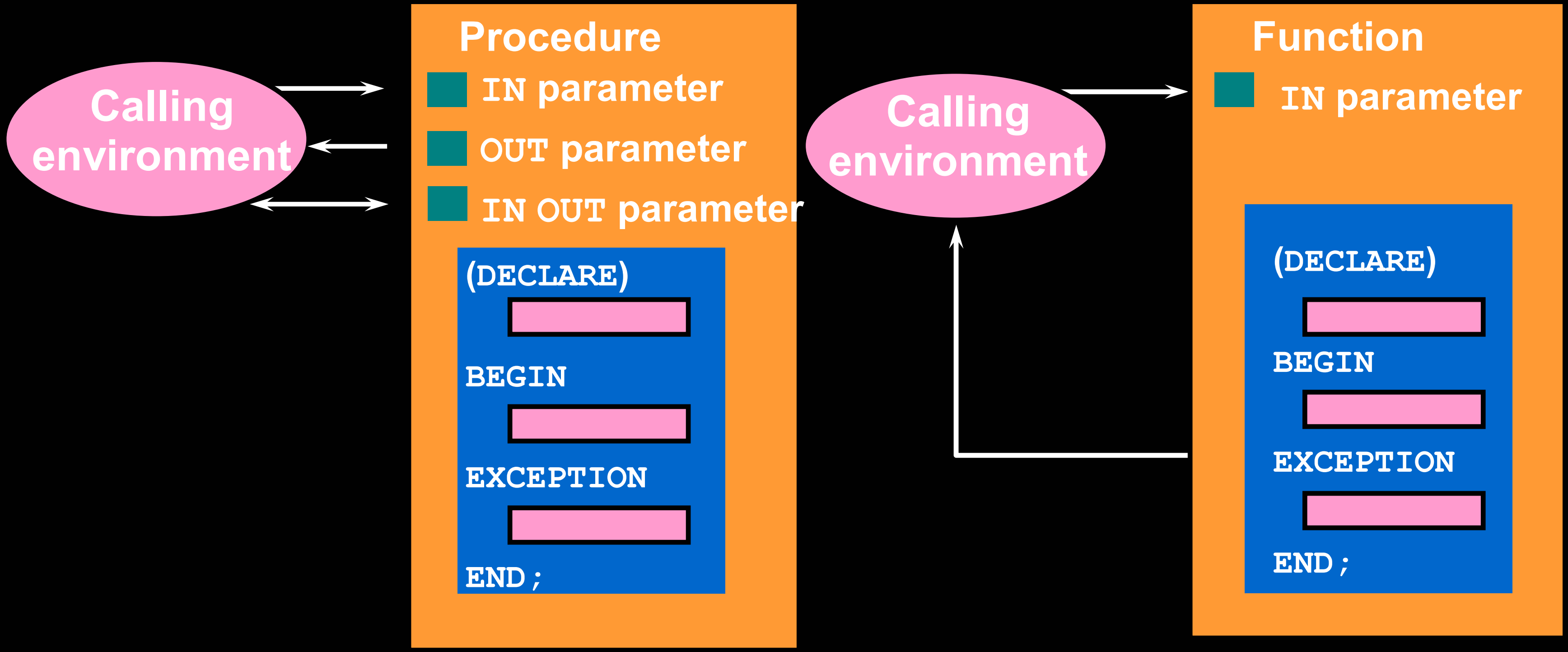
Example:

```
DROP FUNCTION get_sal;
```

```
Function dropped.
```

- **All the privileges granted on a function are revoked when the function is dropped.**
- **The `CREATE OR REPLACE` syntax is equivalent to dropping a function and recreating it. Privileges granted on the function remain the same when this syntax is used.**

Procedure or Function?



Comparing Procedures and Functions

Procedures	Functions
Execute as a PL/SQL statement	Invoke as part of an expression
Do not contain `RETURN` clause in the header	Must contain a `RETURN` clause in the header
Can return none, one, or many values	Must return a single value
Can contain a `RETURN` statement	Must contain at least one `RETURN` statement

Benefits of Stored Procedures and Functions

- Improved performance
- Easy maintenance
- Improved data security and integrity
- Improved code clarity

Summary

In this lesson, you should have learned that:

- A function is a named PL/SQL block that must return a value.
- A function is created by using the `CREATE FUNCTION` syntax.
- A function is invoked as part of an expression.
- A function stored in the database can be called in SQL statements.
- A function can be removed from the database by using the `DROP FUNCTION` syntax.
- Generally, you use a procedure to perform an action and a function to compute a value.

Practice 10 Overview

This practice covers the following topics:

- Creating stored functions
  - To query a database table and return specific values
  - To be used in a SQL statement
  - To insert a new row, with specified parameter values, into a database table
  - Using default parameter values
- Invoking a stored function from a SQL statement
- Invoking a stored function from a stored procedure

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1. Buat fungsi fn_monthHire untuk mendapatkan informasi mengenai bulan mulai bekerja karyawan.
Dengan catatan bahwa hanya Januari saja yang ditampilkan, selain itu beri informasi Bukan Januari.

Kemudian tampilkan dalam query SELECT untuk menampilkan semua data kode karyawan, nama, hire_date dan monthHire dari tabel employees.

Contoh Tabel output :

```
    ==============================================================
    Employee_ID         Last_Name       Hire_Date       MonthHire
    ==============================================================
        124             Saya            10-01-1995      Januari
        125             Kamu            04-06-1996      Bukan Januari
```

2. Buat fungsi fn_info yang akan menampilkan informasi prosentase kenaikan, gaji lama dan gaji baru.
Fungsi memiliki 1 parameter untuk menampung kode karyawan.
Syarat kenaikan :

- untuk kode departemen 10, 50, 110 diberikan kenaikan 5%
- untuk kode departemen 60 diberikan kenaikan 10%
- untuk kode departemen 20 dan 60 diberikan kenaikan 15%
- untuk kode departemen lainnya tidak diberikan kenaikan

Kemudian tampilkan dalam query SELECT untuk menampilkan semua data kode karyawan, nama, dan info dari tabel employees.

Contoh output table :

```
    ================================================================-======================
    Employee_ID         Last_Name       Dept_ID Informasi
    ================================================================-======================
        124             Saya            20      Kenaikan 15%, gaji awal 1000, gaji sekarang 1150
        125             Kamu            90      Tidak ada kenaikan gaji
        126             Andi            10      Kenaikan 10%, gaji awal 1000, gaji sekarang 1100
```