PL/SQL

Procedures
Functions
Triggers

Overview

- Procedures
- Functions
- Triggers

PROCEDURES

- A procedure is a module performing one or more actions; it does not need to return any values.
- Syntax for creating a procedure is as follows:

```
CREATE OR REPLACE PROCEDURE <proc_name>
      [parameter list]
AS
      [local declarations]
BEGIN
      executable statements
[EXCEPTION
      exception handlers]
END [proc_name];
```

PROCEDURES

- A procedure may have 0 to many parameters.
- Every procedure has two parts:
    - The header portion which comes before AS (IS) keyword
        - this contains the procedure name and the parameter list
    - The body
        - which is everything after the IS keyword.
- The word REPLACE is optional.
- When the word REPLACE is not used in the header of the procedure, in order to change the code in the procedure, it must be dropped first and then re-created.

Example-1

```
create or replace procedure
    totalqty as
    total number;
    cursor c is select
    itemname,qty from item
    where
    category='accessories';
    myitem c%rowtype;
begin
    total:=0;
    for myitem in c
    loop

        total:=total+myitem.qt
    y;
    end loop;
    dbms_output.put_line('total
    quantity is'||total);
end;
```

```
create or replace procedure
    totalqty(iname char) as
total number;
cursor c is select
    itemname,qty from item
    where category=iname;
myitem c%rowtype;
begin
total:=0;
for myitem in c
loop
total:=total+myitem.qty;
end loop;
dbms_output.put_line('total
    quantity is'||total);
end;
```

Example-2

```
CREATE OR REPLACE PROCEDURE Discount AS
     CURSOR c_group_discount  IS
      SELECT distinct s.course_no, c.description
      FROM section s, enrollment e, course c
      WHERE s.section_id = e.section_id
              AND c.course_no = s.course_no
     GROUP BY s.course_no, c.description,
              e.section_id, s.section_id
     HAVING COUNT(*) >=8;
BEGIN
```

Example-2 contd.

```
FOR r_group_discount IN c_group_discount
     LOOP
      UPDATE course
             SET cost = cost * .95
      WHERE course_no =
     r_group_discount.course_no;
      DBMS_OUTPUT.PUT_LINE
             ('A 5% discount has been given to'||
             r_group_discount.course_no||' '||
             r_group_discount.description
             );
     END LOOP;
END;
```

Execution

- Syntax to execute a procedure in SQL*Plus:

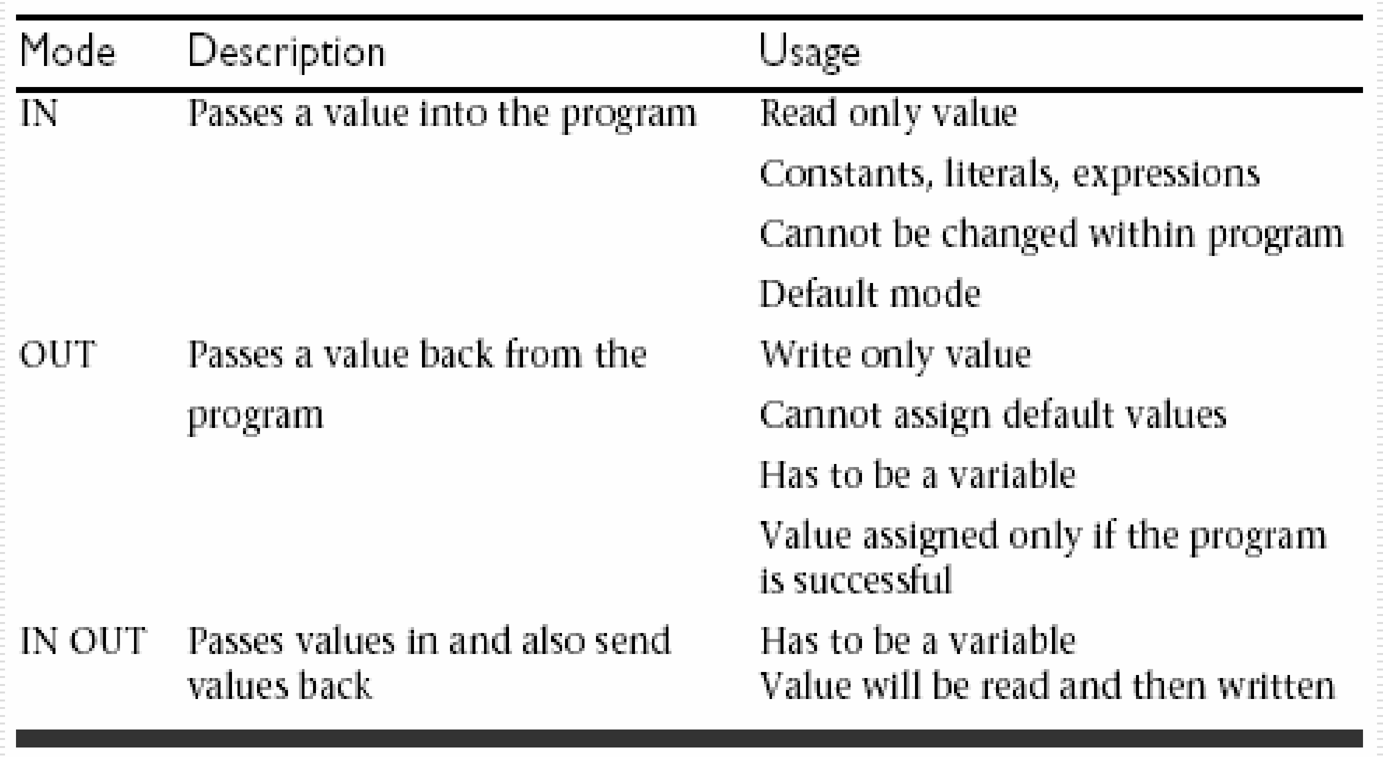
  EXECUTE Procedure_name

```
SQL> EXECUTE Discount
```

PARAMETERS

- Parameters are the means to pass values to and from the calling environment to the server.
- These are the values that will be processed or returned via the execution of the procedure.
- There are three types of parameters:
  - IN
  - OUT
  - IN OUT.
- Modes specify whether the parameter passed is read in or a receptacle for what comes out.

Types of Parameters



Mode	Description	Usage
IN	Passes a value into the program	Read only value
		Constants, literals, expressions
		Cannot be changed within program
		Default mode
OUT	Passes a value back from the program	Write only value
		Cannot assign default values
		Has to be a variable
		Value assigned only if the program is successful
IN OUT	Passes values in and also send values back	Has to be a variable Value will be read and then written

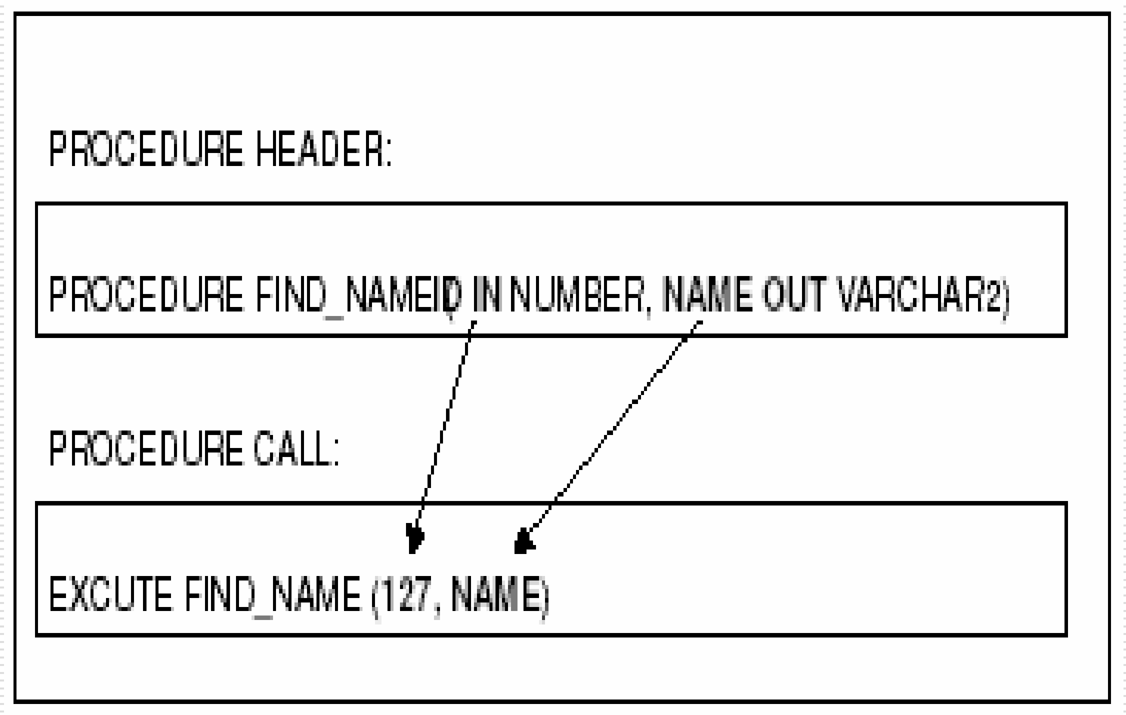
FORMAL AND ACTUAL PARAMETERS

- *Formal parameters* are the names specified within parentheses as part of the header of a module.
- *Actual parameters* are the values—expressions specified within parentheses as a parameter list—when a call is made to the module.
- The formal parameter and the related actual parameter must be of the same or compatible data types.

MATCHING ACTUAL AND FORMAL PARAMETERS

- Two methods can be used to match actual and formal parameters:
  - positional notation
  - named notation - the order does not matter. .
- *Positional notation* is simply association by position: The order of the parameters used when executing the procedure matches the order in the procedure's header exactly.
- *Named notation* is explicit association using the symbol =>
  - Syntax: formal_parameter_name => argument_value
- If you mix notation, list positional notation before named notation.

MATCHING ACTUAL AND FORMAL PARAMETERS



PROCEDURE HEADER:

```
PROCEDURE FIND_NAME(ID IN NUMBER, NAME OUT VARCHAR2)
```

PROCEDURE CALL:

```
EXCUTE FIND_NAME (127, NAME)
```

Example

```
create or replace procedure total(n1 in number,n2 out
     number) as
begin
n2:=mod(n1,2);
end;
```

```
declare
a number;
b number;
begin
total(5,b);
dbms_output.put_line('b is'||b);
end;
```

FUNCTIONS

- Functions are a type of stored code and are very similar to procedures.
- The significant difference is that a function is a PL/SQL block that *returns* a single value.
- Functions can accept one, many, or no parameters, but a function must have a return clause in the executable section of the function.
- The datatype of the return value must be declared in the header of the function.
- A function is not a stand-alone executable in the way that a procedure is: It must be used in some context. You can think of it as a sentence fragment.
- A function has output that needs to be assigned to a variable, or it can be used in a SELECT statement.

FUNCTIONS

- Syntax for creating a function:

```
CREATE [OR REPLACE] FUNCTION
    function_name
    (parameter list)
    RETURN datatype
IS
BEGIN
    <body>
    RETURN (return_value);
END;
```

FUNCTIONS

- The function does not necessarily have to have any parameters, but it must have a RETURN value declared in the header, and it must return values for all the varying possible execution streams.
- The RETURN statement does not have to appear as the last line of the main execution section, and there may be more than one RETURN statement (there should be a RETURN statement for each exception).
- A function may have IN, OUT, or IN OUT parameters (rarely see anything except IN parameters).

Example

```
create or replace function sample
return as
a number;
begin
a:=200;
return a;
end;
```

```
select sample from dual;
```

```
select * from student where regno>sample;
```

Example

```
SQL> show errors
Errors for FUNCTION SAMPLE:

LINE/COL ERROR
-------- -----------------------------------------------------------------
5/2       PLS-00103: Encountered the symbol "=" when expecting
          one of the following:
         := . ( @ % ;
         The symbol ":= was inserted before "=" to continue.
```

Example

```
CREATE OR REPLACE FUNCTION show_description
      (i_course_no number)
RETURN varchar2
AS
      v_description varchar2(50);
BEGIN
      SELECT description  INTO v_description
        FROM course WHERE course_no = i_course_no;
      RETURN v_description;
EXCEPTION
      WHEN NO_DATA_FOUND  THEN
        RETURN('The Course is not in the database');
      WHEN OTHERS  THEN
        RETURN('Error in running show_description');
END;
```

Making Use Of Functions

- In a anonymous block

```
SET SERVEROUTPUT ON
DECLARE
    v_description VARCHAR2(50);
BEGIN
    v_description :=
    show_description(&sv_cnumber);
    DBMS_OUTPUT.PUT_LINE(v_description);
END;
```

- In a SQL statement

```
SELECT course_no, show_description(course_no)
    FROM course;
```

TRIGGERS

- A database trigger is a stored PL/SQL program unit associated with a specific database table.
- ORACLE executes (fires) a database trigger automatically when a given SQL operation (like INSERT, UPDATE or DELETE) affects the table.
- Unlike a procedure, or a function, which must be invoked explicitly, database triggers are invoked implicitly.

TRIGGERS

- Database triggers can be used to perform any of the following:
  - Audit data modification
  - Log events transparently
  - Enforce complex business rules
  - Derive column values automatically
  - Implement complex security authorizations
  - Maintain replicate tables

TRIGGERS

- You can associate up to 12 database triggers with a given table.
- A database trigger has three parts:
  - a **triggering event**
  - an **optional trigger constraint**
  - a **trigger action**.
- When an event occurs, a database trigger is fired, and an predefined PL/SQL block will perform the necessary action.

TRIGGERS - SYNTAX

```
CREATE [OR REPLACE] TRIGGER trigger_name
{BEFORE|AFTER} triggering_event ON table_name
[FOR EACH ROW]
[WHEN condition]
DECLARE
Declaration statements
BEGIN
Executable statements
EXCEPTION
Exception-handling statements
END;
```

TRIGGERS

- The trigger_name references the name of the trigger.
- BEFORE or AFTER specify when the trigger is fired (before or after the triggering event).
- The triggering_event references a DML statement issued against the table (e.g., INSERT, DELETE, UPDATE).
- The table_name is the name of the table associated with the trigger.
- The clause, FOR EACH ROW, specifies a trigger is a row trigger and fires once for each modified row.
- A WHEN clause specifies the condition for a trigger to be fired.
- Bear in mind that if you drop a table, all the associated triggers for the table are dropped as well.

TYPES OF TRIGGERS

- Triggers may be called BEFORE or AFTER the following events:
  - INSERT, UPDATE and DELETE.
- The before/after options can be used to specify when the trigger body should be fired with respect to the triggering statement.
- If the user indicates a BEFORE option, then Oracle fires the trigger before executing the triggering statement.
- If an AFTER is used, Oracle fires the trigger after executing the triggering statement.

TYPES OF TRIGGERS

- A trigger may be a ROW or STATEMENT type. If the statement FOR EACH ROW is present in the CREATE TRIGGER clause of a trigger, the trigger is a row trigger. A row trigger is fired for each row affected by an triggering statement.
- A statement trigger, however, is fired only once for the triggering statement, regardless of the number of rows affected by the triggering statement

Example - Statement trigger

```
CREATE OR REPLACE TRIGGER mytrig1 BEFORE
    DELETE OR INSERT OR UPDATE ON dept
BEGIN
IF (TO_CHAR(SYSDATE, 'day') IN ('sat', 'sun')) OR
    (TO_CHAR(SYSDATE,'hh:mi') NOT BETWEEN
    '08:30' AND '18:30') THEN
    RAISE_APPLICATION_ERROR(-20500, 'table is
    secured');
END IF;
END;
```

- This example shows a trigger that limits the DML actions to the dept table to weekdays from 8.30am to 6.30pm. If a user tries to insert/update/delete a row in the DEPT table, a warning message will be prompted.

Example - ROW Trigger

```
CREATE OR REPLACE TRIGGER mytrig2
AFTER DELETE OR INSERT OR UPDATE ON employee
FOR EACH ROW
BEGIN
IF DELETING THEN
INSERT INTO xemployee (emp_ssn, emp_last_name,emp_first_name, deldate)
VALUES (:old.emp_ssn, :old.emp_last_name,:old.emp_first_name, sysdate);
ELSIF INSERTING THEN
 INSERT INTO nemployee (emp_ssn, emp_last_name,emp_first_name,
      adddate)
VALUES (:new.emp_ssn, :new.emp_last_name,:new.emp_first_name, sysdate);
 ELSIF UPDATING('emp_salary') THEN
INSERT INTO cemployee (emp_ssn, oldsalary, newsalary, up_date)
VALUES (:old.emp_ssn,:old.emp_salary, :new.emp_salary, sysdate);
ELSE
INSERT INTO uemployee (emp_ssn, emp_address, up_date)
VALUES (:old.emp_ssn, :new.emp_address, sysdate);
END IF;
END;
```

TYPES OF TRIGGERS

- The previous trigger is used to keep track of all the transactions performed on the employee table. If any employee is deleted, a new row containing the details of this employee is stored in a table called xemployee. Similarly, if a new employee is inserted, a new row is created in another table called nemployee, and so on.
- Note that we can specify the old and new values of an updated row by prefixing the column names with the :OLD and :NEW qualifiers.

TYPES OF TRIGGERS

```
SQL>  DELETE FROM  employee WHERE
      emp_last_name = 'Joshi';
1 row deleted.
SQL> SELECT * FROM xemployee;
```

```
EMP_SSN   EMP_LAST_NAME
EMP_FIRST_NAME DELDATE
------------- ------------------------   -----------
--------------- -----------------
999333333  Joshi                              Dinesh
02    MAY 03
```

ENABLING, DISABLING, DROPPING TRIGGERS

- SQL>ALTER TRIGGER trigger_name DISABLE;
- SQL>ALTER TABLE table_name DISABLE ALL TRIGGERS;
- **To enable a trigger, which is disabled, we can use the following syntax:**

  SQL>ALTER TABLE table_name ENABLE trigger_name;
- **All triggers can be enabled for a specific table by using the following command**
- SQL> ALTER TABLE table_name ENABLE ALL TRIGGERS;
- SQL> DROP TRIGGER trigger_name