

CHAPTER -15

TRIGGERS

What is a Trigger :

A trigger is a stored procedure that defines an action the database automatically initiates when some database related events such as INSERT, UPDATE OR DELETE occurs.

Why Triggers:

A trigger is a fragment of code that you tell Oracle to run before or after a table is modified. A trigger has the power to :-

- *make sure that a column is filled in with default information*
- *make sure that an audit row is inserted into another table*
- *after finding that the new information is inconsistent with other stuff in the database, raise an error that will cause the entire transaction to be rolled back*

- The different types of integrity constraints provide a *declarative* mechanism to associate “simple” conditions with a table such as a primary key, foreign keys or domain constraints.
- Complex integrity constraints that refer to several tables and attributes cannot be specified within table definitions. *Triggers*, in contrast, provide a procedural technique to specify and maintain integrity constraints.

Triggers Vs Procedures:

- Triggers Execute Implicitly while Procedure execute explicitly.
- It do not accept arguments while Procedures may or may not have arguments.
- Triggers are fired for DML(Insert, Update or Delete) statements while procedures execute all DML statements including SELECT.

Trigger Vs constraints:

- Triggers affect only the row added after the trigger is enabled.
- Affects all the rows in a table

Syntax

```
CREATE [OR REPLACE] TRIGGER trigger_name  
  Before/ after insert/update/ delete  
  [of columnname]  
  ON table_name  
  [For each Row]  
  BEGIN  
    SQL statements;  
  END [triggername];
```

The structure of a row-level

```
CREATE OR REPLACE TRIGGER ***trigger name***
  ***when***
  ON
  ***which table***
  FOR EACH ROW
  ***conditions for firing***
begin
  ***stuff to do***
end;
```

Components of a trigger definition :

trigger name

create [or replace] trigger <trigger name>

■ *trigger time point*

before | after

■ *triggering event(s)*

insert or update [of <column(s)>] or delete on <table>

■ *trigger type* (optional)

for each row

■ *trigger restriction* (only for **for each row** triggers !)

when (<condition>)

■ *trigger body*

<PL/SQL block>

Executing Triggers

When using SQL*Plus, you have to provide a / character to get the program to evaluate a trigger or PL/SQL function definition. You then have to say "**show errors**" if you want SQL*Plus to print out what went wrong. Unless you expect to write perfect code all the time, it can be convenient to leave these SQL*Plus incantations in your .sql files.

Types of Triggers

- Row level triggers
- Statement Level Trigger
- Before and after Trigger
- Instead of Trigger
- Trigger on system events and user events

Example: 1

```
SQL> Create or replace trigger empcount
  After insert on emp
  For each row
  Declare
    n integer;
  Begin
    Select count(*) into n from emp;
    dbms_output.put_line('total no. of records in a table is : '||n);
  End;
```

Accessing coloumn values :

- :old.<colomn name>
- :new.<Colomn name>

.....

**** Points to Remember ****

* Only with a row trigger it is possible to access the attribute values of a tuple before and after the modification (because the trigger is executed once for each row).

* For an **update** trigger, the old attribute value can be accessed using **:old.<column>** and the new attribute value

can be accessed using **:new.<column>**.

* For an **insert** trigger, only **:new.<column>** can be Used.

* for a **delete** trigger only **:old.<column>** can be used (because there exists no old, respectively, new value of the tuple). In these cases, **:new.<column>** refers to the attribute value of <column> of the inserted tuple, and **:old.<column>** refers to the attribute value of <column> of the deleted tuple.

In a row trigger thus it is possible to specify comparisons between old and new attribute values in the PL/SQL block,

e.g., “**if :old.SAL < :new.SAL then . . .**”.

If for a row trigger the trigger time point **before** is specified, it is even possible to modify the new values of the row, e.g., **:new.SAL := :new.SAL * 1.05** or **:new.SAL := :old.SAL**.

*Such modifications are not possible with **after** row triggers.*

Example : 1

```
SQL> Create or replace trigger empcount
      Before delete on emp
      For each row
      Declare
          n integer;
      Begin
          select count(*) into n from emp;
          Dbms_output.put_line('total no. of records in a table is : '||n);
      End;
```

Example : 2

```
SQL> Create or replace trigger EMPUPD
      Before update on emp
      For each row
      Begin
          if :new.salary<:old.salary then
              Dbms_output.put_line('Salary can not be reduced');
      End;
```

Example : 3

statement level trigger-

```
SQL> Create or replace trigger EMPUPD
      Before update on emp
Begin
    if :new.salary<:old.salary then
        Dbms_output.put_line('Salary can not be reduced');
End;
```

Example 4:

```
SQL> Create or replace trigger EMPUPD
      After update on emp
      n number;
Begin
    select count(*) into n from emp;
    Dbms_output.put_line('Total Records in table EMP :'||n);
End;
```

■ **Enabling a Trigger is:**

```
ALTER TRIGGER trigger_name ENABLE;
```

For example:

If you had a trigger called orders_before_insert,
you could enable it with the following command:
ALTER TRIGGER orders_before_insert ENABLE;

Disable a Trigger

syntax :

```
ALTER TRIGGER trigger_name DISABLE;
```

For example:

```
ALTER TRIGGER orders_before_insert DISABLE;
```

Drop a Trigger

syntax :

```
DROP TRIGGER trigger_name;
```

For example:

```
DROP TRIGGER orders_before_insert;
```

Example:

```
create or replace trigger check_budget_EMP
after insert or update of SAL, DEPTNO on EMP
declare
cursor DEPT_CUR is select DEPTNO, BUDGET from DEPT;
    DNO DEPT.DEPTNO%TYPE;
    ALLSAL DEPT.BUDGET%TYPE;
    DEPT_SAL number;
begin
open DEPT_CUR;
```

```

loop
fetch DEPT_CUR into DNO, ALLSAL;
exit when DEPT_CUR%NOTFOUND;
select sum(SAL) into DEPT_SAL from EMP where DEPTNO = DNO;
if DEPT_SAL > ALLSAL then
raise_application_error(-20325, 'Total of salaries in the department '|| to_char(DNO) || ' exceeds
budget');
end if;
end loop;
close DEPT_CUR;
end; /

```

More about triggers :

Triggers are not exclusively used for integrity maintenance. They can also be used for

- Monitoring purposes, such as the monitoring of user accesses and modifications on certain sensitive tables.

- Logging actions, e.g., on tables:

Contd..

```

create trigger LOG EMP
after insert or update or delete on EMP
begin
    if inserting then
        insert into EMP LOG values(user, 'INSERT', sysdate);
    end if ;
    if updating then
        insert into EMP LOG values(user, 'UPDATE', sysdate);
    end if ;
    if deleting then
        insert into EMP LOG values(user, 'DELETE', sysdate);
    end if ;
end;

```

By using a row trigger, even the attribute values of the modified tuples can be stored in the table EMP LOG.

- automatic propagation of modifications. For example, if a manager is transferred to another department, a trigger can be defined that automatically transfers the manager's employees to the new department.

More about Triggers

If a trigger is specified within the SQL*Plus shell, the definition must end with a point “.” in the last line. Issuing the command **run** causes SQL*Plus to compile this trigger definition.

A trigger definition can be loaded from a file using the command **@**. Note that the last line in the file must consist of a slash “/”.

A trigger definition cannot be changed, it can only be re-created using the **or replace** clause.

The command **drop** <trigger name> deletes a trigger.

After a trigger definition has been successfully compiled, the trigger automatically is enabled.

The command **alter trigger** <trigger name> **disable** is used to deactivate a trigger. All

triggers defined on a table can be (de)activated using the command

```
alter table <Tablename> enable | disable all trigger;
```

The data dictionary stores information about triggers in the table USER TRIGGERS. The information includes the trigger name, type, table, and the code for the PL/SQL block.

Difference b/w For and Do Loops: *When No. of repetitions are known then For loop is used, and if the No. of iterations are unknown then do loops are used.*

Difference b/w While and Until: While means as long as the condition is true, the loop execute the body
Whereas Until means as long as the condition is not true, the loop repeats

Exiting from Loop: Exit statement helps to terminate any of the loops directly.

EXIT DO : To terminate any Do loop

EXIT FOR : To terminate for loop

Use of For Each ... Next Loop: It is used to repeat a group of statements for each element in a dynamic array as we are not sure about the size of the array.

Two Basic Operations on Arrays: Traversing means processing each element of the array
Searching means to find a given element in array.

Calling Procedure : It's a procedure that calls another procedure.

Called/Caller Procedure : The procedure being called is known as Called / Caller Procedure.

Actual Parameters : The parameters provided by calling procedures are actual.

Formal Parameters : The parameters received by called procedures are formal.

A sub procedure may call in two ways:

With a call statement -	Call procedure-name (actual arguments list)	Eg: Call abc (x , y)
Without call statement-	procedure – name actual arguments	Eg: abc x, y

If Private/Public keyword is not specified with a procedure then the procedure becomes **Public**.

The value being returned by the function is assigned to the function name, which automatically returns it to the calling procedure or function. A function may return only one value.

*Sub procedure does not return a value, so a call to a sub procedure is a complete statement.

* Function procedure returns a value, so a call to a function procedure is part of an expression.

In a procedure, optional parameters are declared in argument list from right hand side.

Sub OptProcedure(ByVal X as Integer, ByVal Y as Integer, **ByVal Optional Z as Integer**)

VB Passes an argument **by Reference by default**.

Exit sub and **Exit Function** statements can be used to Exit from a sub procedure or a function procedure.

If a variable is declared as **PUBLIC A as Integer** in **form1** and it's **value is 20**, then it can be used in **form2** as **form1.A**.

List the variable scopes in decreasing lifespan: PUBLIC, MODULE, STATIC, LOCAL

Try this:

```
Sub MyProc1 ( )  
    Dim A as Integer  
    A = 12  
    Print A  
    Call MyProc2 ( A )  
    A = A + 2  
    Print A  
End Sub  
Sub MyProc2 ( B as Integer)  
    Print B  
    B = B + 10  
    Print B  
End Sub
```

O/P is:

12
12
22
24

When a number is converted to a string, a leading space is always reserved for its sign.

St = Str (198)	‘ Gives “ 198 ”
St = Str (-198)	‘ Gives “ -198 ”

Cint () function returns truly rounded number. Eg. : Print CInt (-14.8) will print -15.

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