

EXERCISE-17

TRIGGER

DEFINITION

A trigger is a statement that is executed automatically by the system as a side effect of a modification to the database. The parts of a trigger are,

- **Trigger statement:** Specifies the DML statements and fires the trigger body. It also specifies the table to which the trigger is associated.
- **Trigger body or trigger action:** It is a PL/SQL block that is executed when the triggering statement is used.

The different uses of triggers are as follows,

- To generate data automatically
- To enforce complex integrity constraints
- To customize complex securing authorizations
- To maintain the replicate table
- To audit data modifications

TYPES OF TRIGGERS

The various types of triggers are as follows,

- **Before:** It fires the trigger before executing the trigger statement.
- **After:** It fires the trigger after executing the trigger statement
- **For each row:** It specifies that the trigger fires once per row.
- **For each statement:** This is the default trigger that is invoked. It specifies that the trigger fires once per statement.

VARIABLES USED IN TRIGGERS

- :new
- :old

These two variables retain the new and old values of the column updated in the database. The values in these variables can be used in the database triggers for data manipulation

SYNTAX

```
create or replace trigger triggername [before/after] {DML statements}
on [tablename] [for each row/statement]
begin
```

```
-----
exception
end;
```

USER DEFINED ERROR MESSAGE

The package “raise_application_error” is used to issue the user defined error messages

Syntax: raise_application_error(error number, ‘error message’);

The error number can lie between -20000 and -20999.

The error message should be a character string.

TO CREATE THE TABLE ‘ITEMPLS’

```
SQL> create table itempls (ename varchar2(10), eid number(5), salary number(10));
Table created.
```

```
SQL> insert into itempls values('xxx',11,10000);
1 row created.
SQL> insert into itempls values('yyy',12,10500);
1 row created.
```

```
SQL> insert into itempls values('zzz',13,15500);
1 row created.
SQL> select * from itempls;
ENAME EID SALARY
```

ENAME	EID	SALARY
xxx	11	10000
yyy	12	10500
zzz	13	15500

TO CREATE A SIMPLE TRIGGER THAT DOES NOT ALLOW INSERT UPDATE AND DELETE OPERATIONS ON THE TABLE

```
SQL> create trigger ittrigg before insert or update or delete on itempls for each row
```

```
2 begin
3 raise_application_error(-20010,'You cannot do manipulation');
4 end;
5
6 /
```

Trigger created.

```
SQL> insert into itempls values('aaa',14,34000);
insert into itempls values('aaa',14,34000)
*
```

ERROR at line 1:

ORA-20010: You cannot do manipulation

ORA-06512: at "STUDENT.ITTRIGG", line 2

ORA-04088: error during execution of trigger 'STUDENT.ITTRIGG'

```
SQL> delete from itempls where ename='xxx';
delete from itempls where ename='xxx'
*
```

ERROR at line 1:

ORA-20010: You cannot do manipulation

ORA-06512: at "STUDENT.ITTRIGG", line 2

ORA-04088: error during execution of trigger 'STUDENT.ITTRIGG'

```
SQL> update itempls set eid=15 where ename='yyy';
update itempls set eid=15 where ename='yyy'
*
```

ERROR at line 1:

ORA-20010: You cannot do manipulation

ORA-06512: at "STUDENT.ITTRIGG", line 2

ORA-04088: error during execution of trigger 'STUDENT.ITTRIGG'

TO DROP THE CREATED TRIGGER

```
SQL> drop trigger ittrigg;
```

Trigger dropped.

TO CREATE A TRIGGER THAT RAISES AN USER DEFINED ERROR MESSAGE AND DOES NOT ALLOW UPDATION AND INSERTION

```
SQL> create trigger ittriggs before insert or update of salary on itempls for each row
  2 declare
  3   triggsal itempls.salary%type;
  4 begin
  5   select salary into triggsal from itempls where eid=12;
  6   if(:new.salary>triggsal or :new.salary<triggsal) then
  7     raise_application_error(-20100,'Salary has not been changed');
  8   end if;
  9 end;
10 /
```

Trigger created.

```
SQL> insert into itempls values ('bbb',16,45000);
insert into itempls values ('bbb',16,45000)
*
```

ERROR at line 1:

```
ORA-04098: trigger 'STUDENT.ITTRIGGS' is invalid and failed re-validation
SQL> update itempls set eid=18 where ename='zzz';
update itempls set eid=18 where ename='zzz'
*
```

ERROR at line 1:

```
ORA-04298: trigger 'STUDENT.ITTRIGGS' is invalid and failed re-validation
```

Cursor for loop

- Explicit cursor
- Implicit cursor

TO CREATE THE TABLE 'SSEMPP'

```
SQL> create table ssempp( eid number(10), ename varchar2(20), job varchar2(20), sal number(10), dnonumber(5));
Table created.
```

```
SQL> insert into ssempp values(1,'nala','lecturer',34000,11);
1 row created.
```

```
SQL> insert into ssempp values(2,'kala','seniorlecturer',20000,12);
1 row created.
```

```
SQL> insert into ssempp values(5,'ajay','lecturer',30000,11);
1 row created.
```

```
SQL> insert into ssempp values(6,'vijay','lecturer',18000,11);
1 row created.
```

```
SQL> insert into ssempp values(3,'nila','professor',60000,12);
```

1 row created.

SQL> select * from ssempp;

EID	ENAME	JOB	SAL	DNO
1	nala	lecturer	34000	11
2	kala	seniorlecturer	20000	12
5	ajay	lecturer	30000	11
6	vijay	lecturer	18000	11
3	nila	professor	60000	12

EXTRA PROGRAMS

TO WRITE A PL/SQL BLOCK TO DISPLAY THE EMPLOYEE ID AND EMPLOYEE NAME USING CURSOR FOR LOOP

SQL> set serveroutput on;

SQL> declare

```
2 begin
3 for emy in (select eid,ename from ssempp)
4 loop
5 dbms_output.put_line('Employee id and employee name are '|| emy.eid 'and'|| emy.ename);
6 end loop;
7 end;
8 /
```

Employee id and employee name are 1 and nala

Employee id and employee name are 2 and kala

Employee id and employee name are 5 and ajay

Employee id and employee name are 6 and vijay

Employee id and employee name are 3 and nila

PL/SQL procedure successfully completed.

TO WRITE A PL/SQL BLOCK TO UPDATE THE SALARY OF ALL EMPLOYEES WHERE DEPARTMENT NO IS 11 BY 5000 USING CURSOR FOR LOOP AND TO DISPLAY THE UPDATED TABLE

SQL> set serveroutput on;

SQL> declare

```
2 cursor cem is select eid,ename,sal,dno from ssempp where dno=11;
3 begin
4 --open cem;
5 for rem in cem
6 loop
7 update ssempp set sal=rem.sal+5000 where eid=rem.eid;
8 end loop;
9 --close cem;
10 end;
11 /
```

PL/SQL procedure successfully completed.

SQL> select * from ssempp;

EID	ENAME	JOB	SAL	DNO
1	nala	lecturer	39000	11
2	kala	seniorlecturer	20000	12
5	ajay	lecturer	35000	11
6	vijay	lecturer	23000	11
3	nila	professor	60000	12

TO WRITE A PL/SQL BLOCK TO DISPLAY THE EMPLOYEE ID AND EMPLOYEE NAME WHERE DEPARTMENT NUMBER IS 11 USING EXPLICIT CURSORS

```
1 declare
2 cursor cenl is select eid,sal from ssempp where dno=11;
3 ecode ssempp.eid%type;
4 esal empp.sal%type;
5 begin
6 open cenl;
7 loop
8 fetch cenl into ecode,esal;
9 exit when cenl%notfound;
10 dbms_output.put_line(' Employee code and employee salary are' || ecode 'and' || esal);
11 end loop;
12 close cenl;
13* end;
SQL> /
```

Employee code and employee salary are 1 and 39000

Employee code and employee salary are 5 and 35000

Employee code and employee salary are 6 and 23000

PL/SQL procedure successfully completed.

TO WRITE A PL/SQL BLOCK TO UPDATE THE SALARY BY 5000 WHERE THE JOB IS LECTURER , TO CHECK IF UPDATES ARE MADE USING IMPLICIT CURSORS AND TO DISPLAY THE UPDATED TABLE

```
SQL> declare
2 county number;
3 begin
4 update ssempp set sal=sal+10000 where job='lecturer';
5 county:=sql%rowcount;
6 if county > 0 then
7 dbms_output.put_line('The number of rows are'|| county);
8 end if;
9 if sql %found then
10 dbms_output.put_line('Employee record modification successful');
11 else if sql%notfound then
12 dbms_output.put_line('Employee record is not found');
13 end if;
14 end if;
```

```
15 end;
16 /
The number of rows are 3
```

Employee record modification successful

PL/SQL procedure successfully completed.

```
SQL> select * from ssempp;
```

EID	ENAME	JOB	SAL	DNO
1	nala	lecturer	44000	11
2	kala	seniorlecturer	20000	12
5	ajay	lecturer	40000	11
6	vijay	lecturer	28000	11
3	nila	professor	60000	12

PROGRAMS

TO DISPLAY HELLO MESSAGE

```
SQL> set serveroutput on;
SQL> declare
2 a varchar2(20);
3 begin
4 a:='Hello';
5 dbms_output.put_line(a);
6 end;
7 /
Hello
PL/SQL procedure successfully completed.
```

TO INPUT A VALUE FROM THE USER AND DISPLAY IT

```
SQL> set serveroutput on;
SQL> declare
2 a varchar2(20);
3 begin
4 a:=&a;
5 dbms_output.put_line(a);
6 end;
7 /
Enter value for a: 5
old 4: a:=&a;
new 4: a:=5;
5
```

PL/SQL procedure successfully completed.

GREATEST OF TWO NUMBERS

SQL> set serveroutput on;

```
SQL> declare
  2  a number(7);
  3  b number(7);
  4  begin
  5  a:=&a;
  6  b:=&b;
  7  if(a>b) then
  8    dbms_output.put_line ('The greater of the two is'|| a);
  9  else
10    dbms_output.put_line ('The greater of the two is'|| b);
11  end if;
12 end;
13 /
```

Enter value for a: 5

old 5: a:=&a;

new 5: a:=5;

Enter value for b: 9

old 6: b:=&b;

new 6: b:=9;

The greater of the two is9

PL/SQL procedure successfully completed.

GREATEST OF THREE NUMBERS

SQL> set serveroutput on;

```
SQL> declare
  2  a number(7);
  3  b number(7);
  4  c number(7);
  5  begin
  6  a:=&a;
  7  b:=&b;
  8  c:=&c;
  9  if(a>b and a>c) then
10    dbms_output.put_line ('The greatest of the three is '|| a);
11  else if(b>c) then
12    dbms_output.put_line ('The greatest of the three is '|| b);
13  else
14    dbms_output.put_line ('The greatest of the three is '|| c);
15  end if;
16 end if;
17 end;
18 /
```

Enter value for a: 5

```
old 6: a:=&a;
new 6: a:=5;
Enter value for b: 7
old 7: b:=&b;
new 7: b:=7;
Enter value for c: 1
old 8: c:=&c;
new 8: c:=1;
The greatest of the three is 7
```

PL/SQL procedure successfully completed.

PRINT NUMBERS FROM 1 TO 5 USING SIMPLE LOOP

```
SQL> set serveroutput on;
```

```
SQL> declare
 2 a number:=1;
 3 begin
 4 loop
 5 dbms_output.put_line(a);
 6 a:=a+1;
 7 exit when a>5;
 8 end loop;
 9 end;
10 /
```

```
1
2
3
4
5
```

PL/SQL procedure successfully completed.

PRINT NUMBERS FROM 1 TO 4 USING WHILE LOOP

```
SQL> set serveroutput on;
```

```
SQL> declare
 2 a number:=1;
 3 begin
 4 while(a<5)
 5 loop
 6 dbms_output.put_line(a);
 7 a:=a+1;
 8 end loop;
 9 end;
10 /
```

1
2
3
4

PL/SQL procedure successfully completed.

PRINT NUMBERS FROM 1 TO 5 USING FOR LOOP

```
SQL> set serveroutput on;
SQL> declare
2 a number:=1;
3 begin
4 for a in 1..5
5 loop
6 dbms_output.put_line(a);
7 end loop;
8 end;
9 /
```

1
2
3
4
5

PL/SQL procedure successfully completed.

PRINT NUMBERS FROM 1 TO 5 IN REVERSE ORDER USING FOR LOOP

```
SQL> set serveroutput on;
SQL> declare
2 a number:=1;
3 begin
4 for a in reverse 1..5
5 loop
6 dbms_output.put_line(a);
7 end loop;
8 end;
9 /
```

5
4
3
2
1

PL/SQL procedure successfully completed.

TO CALCULATE AREA OF CIRCLE

```
SQL> set serveroutput on;
SQL> declare
2 pi constant number(4,2):=3.14;
3 a number(20);
4 r number(20);
5 begin
```

```
6 r:=&r;
7 a:= pi* power(r,2);
8 dbms_output.put_line ('The area of circle is '|| a);
9 end;
10 /
Enter value for r: 2
old 6: r:=&r;
new 6: r:=2;
The area of circle is 13
PL/SQL procedure successfully completed.
```

TO CREATE SACCOUNT TABLE

```
SQL> create table saccount ( accno number(5), name varchar2(20), bal number(10));
Table created.
SQL> insert into saccount values ( 1,'mala',20000);
1 row created.
SQL> insert into saccount values (2,'kala',30000);
1 row created.
SQL> select * from saccount;
ACCNO NAME BAL
```

```
1 mala 20000
2 kala 30000
SQL> set serveroutput on;
SQL> declare
2 a_bal number(7);
3 a_no varchar2(20);
4 debit number(7):=2000;
5 minamt number(7):=500;
6 begin
7 a_no:=&a_no;
8 select bal into a_bal from saccount where accno= a_no;
9 a_bal:=a_bal-debit;
10 if(a_bal > minamt) then
11 update saccount set bal=bal-debit where accno=a_no;
12 end if;
13 end;
14
15 /
Enter value for a_no: 1
```

```
old 7: a_no:=&a_no;
new 7: a_no:=1;
PL/SQL procedure successfully completed.
SQL> select * from saccount;
ACCNO NAME BAL
```

```
1 mala 18000
2 kala 30000
```

TO CREATE TABLE SROUTES

```
SQL> create table sroutes ( rno number(5), origin varchar2(20), destination varchar2(20), fare
numbe
r(10), distance number(10));
Table created.
```

```
SQL> insert into sroutes values ( 2, 'chennai', 'dindugal', 400,230);
1 row created.
SQL> insert into sroutes values ( 3, 'chennai', 'madurai', 250,300);
1 row created.
SQL> insert into sroutes values ( 6, 'thanjavur', 'palani', 350,370);
1 row created.
SQL> select * from sroutes;
```

RNO	ORIGIN	DESTINATION	FARE	DISTANCE
2	chennai	dindugal	400	230
3	chennai	madurai	250	300
6	thanjavur	palani	350	370

```
SQL> set serveroutput on;
```

```
SQL> declare
 2 route sroutes.rno % type;
 3 fares sroutes.fare % type;
 4 dist sroutes.distance % type;
 5 begin
 6 route:=&route;
 7 select fare, distance into fares , dist from sroutes where rno=route;
 8 if(dist < 250) then
 9 update sroutes set fare=300 where rno=route;
10 else if dist between 250 and 370 then
11 update sroutes set fare=400 where rno=route;
12 else if (dist > 400) then
13 dbms_output.put_line('Sorry');
14 end if;
15 end if;
16 end if;
17 end;
18 /
```

Enter value for route: 3
old 6: route:=&route;
new 6: route:=3;

TO CALCULATE FACTORIAL OF A GIVEN NUMBER

```
SQL> set serveroutput on;
SQL> declare
 2 f number(4):=1;
```

```

3 i number(4);
4 begin
5 i:=&i;
6 while(i>=1)
7 loop
8 f:=f*i;
9 i:=i-1;
10 end loop;
11 dbms_output.put_line('The value is ' || f);
12 end;
13 /
Enter value for i: 5
old 5: i:=&i;
new 5: i:=5;
The value is 120
PL/SQL procedure successfully completed.

```

Program 1

Write a code in PL/SQL to develop a trigger that enforces referential integrity by preventing the deletion of a parent record if child records exist.

```

CREATE OR REPLACE TRIGGER trg_prevent_parent_delete
BEFORE DELETE ON department
FOR EACH ROW
DECLARE
v_count NUMBER;
BEGIN
SELECT COUNT(*) INTO v_count FROM employee WHERE dept_id = :OLD.dept_id;
IF v_count > 0 THEN
RAISE_APPLICATION_ERROR(-20001, 'Cannot delete parent record. Child records exist in
EMPLOYEE table.');
END IF;
END;
/

```

Program 2

Write a code in PL/SQL to create a trigger that checks for duplicate values in a specific column and raises an exception if found.

```

CREATE OR REPLACE TRIGGER trg_check_duplicate_email
BEFORE INSERT OR UPDATE ON students
FOR EACH ROW
DECLARE
v_count NUMBER;
BEGIN
SELECT COUNT(*) INTO v_count FROM students WHERE email = :NEW.email;
IF v_count > 0 THEN
RAISE_APPLICATION_ERROR(-20002, 'Duplicate email detected. Each email must be

```

```
unique.');
END IF;
END;
```

Program 3

Write a code in PL/SQL to create a trigger that restricts the insertion of new rows if the total of a column's values exceeds a certain threshold.

```
CREATE OR REPLACE TRIGGER trg_limit_total_salary
BEFORE INSERT ON employee
FOR EACH ROW
DECLARE
    v_total NUMBER;
    v_threshold CONSTANT NUMBER := 100000;
BEGIN
    SELECT NVL(SUM(salary), 0) INTO v_total FROM employee;
    IF (v_total + :NEW.salary) > v_threshold THEN
        RAISE_APPLICATION_ERROR(-20003, 'Total salary exceeds the allowed threshold.');
    END IF;
END;
/
```

Program 4

Write a code in PL/SQL to design a trigger that captures changes made to specific columns and logs them in an audit table.

```
CREATE TABLE employee_audit(
    emp_id NUMBER, old_salary NUMBER, new_salary NUMBER,
    change_date DATE,
    changed_by VARCHAR2(30)
);
```

```
CREATE OR REPLACE TRIGGER trg_audit_salary_change
AFTER UPDATE OF salary ON employee
FOR EACH ROW
BEGIN
    INSERT INTO employee_audit(emp_id, old_salary, new_salary, change_date, changed_by)
    VALUES(:OLD.emp_id, :OLD.salary, :NEW.salary, SYSDATE, USER);
END;
/
```

Program 5

Write a code in PL/SQL to implement a trigger that records user activity (inserts, updates, deletes) in an audit log for a given set of tables.

```
CREATE TABLE activity_log(
    table_name VARCHAR2(50),
```

```

operation_type VARCHAR2(20),
user_name VARCHAR2(30),
activity_date DATE
);
CREATE OR REPLACE TRIGGER trg_user_activity
AFTER INSERT OR UPDATE OR DELETE ON employee
BEGIN
  INSERT INTO activity_log(table_name, operation_type, user_name, activity_date)
  VALUES('EMPLOYEE', ORA_SYSEVENT, USER, SYSDATE);
END;
/

```

Program 6

Write a code in PL/SQL to implement a trigger that automatically calculates and updates a running total column for a table whenever new rows are inserted.

```

CREATE TABLE sales(
sale_id NUMBER,
amount NUMBER,
running_total NUMBER
);

```

```

CREATE OR REPLACE TRIGGER trg_update_running_total
AFTER INSERT ON sales
FOR EACH ROW
DECLARE
  v_total NUMBER;
BEGIN
  SELECT NVL(SUM(amount), 0) INTO v_total FROM sales;
  UPDATE sales SET running_total = v_total WHERE sale_id = :NEW.sale_id;
END;
/

```

Program 7

Write a code in PL/SQL to create a trigger that validates the availability of items before allowing an order to be placed, considering stock levels and pending orders.

```

CREATE OR REPLACE TRIGGER trg_check_stock_availability
BEFORE INSERT ON orders
FOR EACH ROW
DECLARE
  v_stock NUMBER;
BEGIN
  SELECT quantity_in_stock INTO v_stock FROM inventory WHERE item_id =:NEW.item_id;
  IF v_stock < :NEW.order_quantity THEN
    RAISE_APPLICATION_ERROR(-20004, 'Insufficient stock available for the requested item.');
  END IF;
END;

```

Evaluation Procedure	Marks awarded
PL/SQL Procedure(5)	5
Program/Execution (5)	5
Viva(5)	5
Total (15)	15
Faculty Signature	TBPL