

Database Programming with PL/SQL

13-2: Creating DML Triggers: Part I

Practice Activities

**Vocabulary**

Identify the vocabulary word for each definition below.

|  |  |
| --- | --- |
| ROW trigger | fires once for each row affected by the triggering event. |
| DML triggerA row trigger | A trigger which is automatically fired (executed) whenever a SQL DML statement (INSERT, UPDATE or DELETE) is executed. |
| **Statement trigger** | is fired once on behalf of the triggering event, even if no rows are affected at all. |

**Try It / Solve It**

1. When creating a DML statement trigger on a table, what are the components that you must define?

Timing: values are BEFORE, AFTER, INSTEAD OF and event: values are INSERT, UPDATE, DELETE, object\_name: The table or view associated with the trigger, trigger\_body: actions performed by the trigger defined in an anonymus block.

1. A business rule states that each time one or more employees are added to the EMPLOYEES table, an audit record must also be created. This rule could be enforced using application code, but we have decided to enforce it using a DML statement trigger.

* 1. Create the AUDIT\_TABLE by executing the following SQL statement:

CREATE TABLE audit\_table

(action VARCHAR2(50), user\_name VARCHAR2(30) DEFAULT USER,

last\_change\_date TIMESTAMP DEFAULT SYSTIMESTAMP);

* 1. Create a statement-level trigger that inserts a row into the AUDIT\_TABLE immediately after one or more rows are added to the EMPLOYEES table. The AUDIT\_TABLE row should contain value “Inserting” in the action column. The other two columns should have their default values. Save your trigger code for later.

CREATE OR REPLACE TRIGGER trigg\_audit\_table

AFTER INSERT ON copy\_employees

BEGIN

INSERT INTO audit\_table(action)

VALUES('Inserting');

END;

* 1. Test your trigger by inserting a row into EMPLOYEES, then querying the AUDIT\_TABLE to see that it contains a row.

INSERT INTO copy\_employees(employee\_id, first\_name, last\_name,email, hire\_date, job\_id)

VALUES

(120, 'Popescu', 'Ionescu','ppopescu', SYSDATE, 200);

* 1. Make sure the trigger does not fire with a DELETE by deleting the employee you just entered. Recheck the AUDIT\_TABLE to make sure that there is not another new row.

DELETE FROM copy\_employees

WHERE first\_name = 'Popescu';

SELECT\*

FROM audit\_table;

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1. True or false? A row trigger fires at least once even if no rows are affected.

FALSE

What is the difference between a statement trigger and a row trigger?

Statement trigger se executa pentru intreaga instructiunea DML, in timp ce a row trigger se xecuta pentru feicare linie afectata de instructiunea DML

1. Imagine that the following DML triggers have been defined on the EMPLOYEES table:
   * + A Before Insert statement trigger
     + A Before Update statement trigger
     + An After Delete statement trigger

An UPDATE statement updates three employee rows. How many times will each trigger fire?

O singura data.

1. Modify your AUDIT\_TABLE trigger from question 2B so that it inserts a row into the audit table immediately before one or more employee salaries are updated. The AUDIT\_TABLE row should contain value “Updating” in the action column.

CREATE OR REPLACE TRIGGER trigg\_audit\_table

BEFORE UPDATE ON copy\_employees

BEGIN

INSERT INTO audit\_table(action)

VALUES('Updating');

END;

Test your modified trigger by updating the salary of a non-existent employee (employee\_id = 999), then querying the AUDIT\_TABLE to see that it contains a new row.

UPDATE copy\_employees

SET salary = 10000

WHERE employee\_id = 2200;

Contine o linie noua.

* 1. Modify your trigger so that it prevents employees’ salaries being updated outside working hours. The trigger should allow UPDATEs at other times (and still insert a row into the

AUDIT\_TABLE), but should raise an application error if an update is attempted before 8:00 am or after 6:00 pm on any day. (HINT: use HH24:MI to extract the time from SYSDATE).

CREATE OR REPLACE TRIGGER trigg\_audit\_table

BEFORE UPDATE OF salary ON copy\_employees

BEGIN

IF (TO\_CHAR(SYSDATE, 'HH24') < 8 OR TO\_CHAR(SYSDATE, 'HH24') > 18)

THEN

RAISE\_APPLICATION\_ERROR(-20101, 'Update during business hours');

END IF;

INSERT INTO audit\_table(ACTION)

VALUES('Updating');

END;

* 1. You want to test your modified trigger. However, you need to make sure that right now the database time is outside working hours. Remember that the database could be anywhere in the world and therefore the database may not be in your time zone! Find the current database time by executing:

SELECT TO\_CHAR(SYSDATE,'HH24:MI') FROM dual;

If needed, modify your trigger so that it will raise the application error if you try to update a salary within the next hour. For example, if the database time is 10:30, modify the trigger code to include: …BETWEEN '10:30' AND '11:30'…

Test your modified trigger by trying to update the salary of employee\_id 100 to a new value of 25000. You should see the ORA-20204 error message.

UPDATE employees

SET salary = 25000

WHERE employee\_id = 100;

CREATE OR REPLACE TRIGGER trigg\_audit\_table

BEFORE UPDATE OF salary ON copy\_employees

BEGIN

IF (TO\_CHAR(SYSDATE, 'HH24:MI') > '17:15' OR TO\_CHAR(SYSDATE, 'HH24:MI') < '18:15')

THEN

RAISE\_APPLICATION\_ERROR(-20101, 'Update during business hours');

END IF;

INSERT INTO audit\_table(ACTION)

VALUES('Updating');

END;