**EXERCISE**

1. **What are triggers? Differentiate between database triggers and form triggers.**

A database trigger is special stored procedure that is run when specific actions occur within a database.

Difference between database triggers and form triggers

A database trigger is fired when a DML operation is fired on some database table. On the other hand, form triggers are fired when user makes some event like pressing a key or navigating between fields of a form. A database trigger can be fired from any session executing the triggering DML statements. While form trigger is specific to the form. Database triggers can cause other database triggers to fire. On the other hand, form triggers cannot cause other form triggers to fire.

1. **Differentiate between Statement and Row triggers?**

A statement-level trigger will be activated **once** (and even if no rows are updated). A row-level trigger will be activated a million times, **once for every updated row**.

1. **What is meant by triggering event? Give examples.**

A triggering event is a tangible or intangible barrier or occurrence which, once breached or met, causes another event to occur. Triggering events include job loss, [retirement](https://www.investopedia.com/articles/retirement/07/sixstages.asp), or death and are typical for many types of contracts. These triggers help to prevent, or ensure, that in the case of a catastrophic change, the terms of an original contract may also change.

[Life insurance policies](https://www.investopedia.com/articles/personal-finance/121914/life-insurance-policies-how-payouts-work.asp) may include a triggering event based on the insured age. Also, many employers require employees to reach a qualifying period of employment as a triggering event for eligibility to specific company benefits. In the investment sphere, stops are a triggering event which the [investor](https://www.investopedia.com/terms/i/investor.asp) may initiate to limit their [downside risk](https://www.investopedia.com/terms/d/downsiderisk.asp).

1. **Give three examples of a situation when a BEFORE statement trigger is needed?**

For example, create one trigger to restrict all data manipulation events on the EMP table to certain business hours, Monday through Friday.

CREATE OR REPLACE TRIGGER secure\_emp

BEFORE INSERT OR UPDATE OR DELETE ON emp

BEGIN

IF (TO\_CHAR(sysdate, 'DY') IN ('SAT', 'SUN'))

OR (TO\_CHAR(sysdate, 'HH24') NOT BETWEEN '08' AND '18') THEN

IF DELETING THEN

RAISE\_APPLICATION\_ERROR (-20502, 'You may only delete from EMP during normal hours.');

ELSIF INSERTING THEN

RAISE\_APPLICATION\_ERROR (-20500, 'You may only insert into EMP during normal hours.');

ELSIF UPDATING(‘SAL’) THEN

RAISE\_APPLICATION\_ERROR (-20503, 'You may only update SAL during normal hours.');

ELSE

RAISE\_APPLICATION\_ERROR (-20504, 'You may only update EMP during normal hours.');

END IF;

END IF;

END;

1. **Give three examples of a situation when a AFTER statement trigger is needed?**

Suppose we have a user defined audit table that lists users and counts their data manipulation operations. After any user has updated the SAL column in the EMP table, use the audit table to ensure that the number of salary changes does not exceed the maximum permitted for that user.

**User Audit Table**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **USER\_ NAME** | **TABLE\_NAME** | **COLUMN\_NAME** | **INS** | **UPD** | **DEL** | **MAX\_INS** | **MAX\_UPD** | **MAX\_DEL** |
| SCOTT | EMP |  | 1 | 1 | 1 | 5 | 5 | 5 |
| SCOTT | EMP | SAL |  | 1 |  |  | 5 |  |
| SCOTT | EMP |  | 0 | 0 | 0 | 5 | 0 | 0 |

**After Update Trigger:**

**CREATE OR REPLACE TRIGGER check\_salary\_count**

AFTER UPDATE OF sal ON emp

DECLARE

v\_salary\_changes NUMBER;

v\_max\_changes NUMBER;

BEGIN

SELECT upd, max\_upd

INTO v\_salary\_changes, v\_max\_changes

FROM audit\_table

WHERE user\_name = user

AND tablename = 'EMP'

AND column\_name = 'SAL';

IF v\_salary\_changes > v\_max\_changes THEN

RAISE\_APPLICATION\_ERROR (-20501, 'You may only make a maximum of '

|| to\_char(v\_max\_changes) || ' changes to the sal column'); END IF; END;