Triggers

Database Management Systems

Triggers

- Triggers a pieces of code (a special type of stored procedure) executed automatically upon certain database operations.
- Triggers do not return a value.
- Triggers are executed by the system automatically transparently.
- Triggers are defined on a table.

Triggers

- Trigger are used for
  - Making a backup of statement/data
  - Creating audits
  - Alerting user when certain situations arise
  - Maintaining a copy of a table
  - Maintaning certain summary/reports

Triggers

- The syntax for a trigger is as follows:

```
create trigger trigger-name before|after
   insert|update (of)|delete on table-name
   (for each statement
   ref. old table as o-t ref. new table a n-t)|
   (for each row
   ref. old record as o-r ref.record as n-r)
when condition
Begin
   trigger-body
End;
```

Triggers

- insert|update (of)|delete (Statement type) indicates for what type of statements the trigger is defined (more than one can be selected)
- before|after (execution time) determines whether the trigger is executed before or after the statement (that triggers/starts the trigger) is executed.
- when provides a condition that must be satisfied in order to execute the trigger, otherwise trigger is not executed.
- for each statement|row (execution model) indicates whether the trigger is executed once for the statement (regardless of no. of records) or once for each row affected by the statement.
- (for each statement only) the table instances before and after the execution of the trigger can be accessed using o-t and n-t.
- (for each row only) the row before and after the execution of the trigger can be accessed using o-r and n-r objects.

Triggers

- Based on type of statements (3), execution time (2), and execution model (2) one can write 12 different triggers on table.
- There are other types of triggers such as the ones defined for DDL statement.
- Trigger body can contain SQL statements and programming statements.

Triggers

- Limitation/Problem
- Can a trigger execute a stetement that causes to trigger itself again
- Can a trigger execute ststements that trigger other triggers
- Can a trigger execute ststements that trigger other triggers which trigger the same trigger in cylic manner (indirect recursion)

Trigger Execution Model

- When there are both statement and row level trigger, row-level triggers take precedence.
- Changes on table by row-level is reflected on the table for the statement-level trigers.

Here is the order of execution:

1. before insert on table for each statement
2. before insert on table for each row
3. insert into table values(...) Statement
4. after insert on table for each row
5. after insert on table for each statement

Trigger-How changes are reflected

- Changes between row-level triggers should be invisible
- Changes between row-level and statement-level triggers should be visible

Triggers-Prerequisiztes

- You mush have create trigger priviledge to create a trigger.
- No priviledge is necessary to execute a trigger.
- Explicit rights are required for the tables accessed in a trigger body.
- Use show errors to display errors

```
create or replace trigger stu_ins_ins_take  after insert on take
for each row
declare
    b float;
begin
    select avg(grade) into b from take; // Error in Oracle: Cant
    access the table beigng inserted
    b:=7;
    insert into student_instructor  values (:new.iid,:new.sid,b);
end
```