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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
Lab-3 : Triggers in Database Security

Pre-Lab:

Q1. What is a trigger in sql? What all events are triggers written to be executed in response to?

Sol) Triggers are stored programs, which are automatically executed or fired when some events occur. Triggers are, in fact, written to be executed in response to any of these following events. A database manipulation (DML) statement (DELETE, INSERT, or UPDATE) •A database definition (DDL) statement (CREATE, ALTER, or DROP). • A database operation (SERVERERROR, LOGON, LOGOFF, STARTUP, or SHUTDOWN).

Q2. Write the syntax of a trigger.

Sol) CREATE OR REPLACE trigger_name

{BEFORE | AFTER | INSTEAD OF}

{INSERT [OR] UPDATE [OR] DELETE}

[OF col_name]

ON table_name

[REFERENCING OLD AS o NEW AS n]

[FOR EACH ROW]

WHEN(condition)

DECALRE

    Declaration-statements

BEGIN

    Executable-statements

EXCEPTION

    Exception-handling-statements

END;

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Q3. What is the TO_CHAR function in sql? Write its syntax.

Sol) In Oracle, TO_CHAR function converts a datetime value (DATE, TIMESTAMP data types i.e.) to a string using the specified format

Syntax:

TO_CHAR(number1, [format], [nls_parameter])

Q4. What is SYSDATE in sql?

Sol) SYSDATE returns the current date and time set for the operating system on which the database resides. The datatype of the returned value is DATE, and the format returned depends on the value of the NLS_DATE_FORMAT initialization parameter.

Q5. Which format specifier of the 'TO_CHAR' function is used to convert a datetime value to Day?

Sol) DY

Q6. How to raise an error in sql? Write its syntax.

Sol) The RAISERROR statement allows you to generate your own error messages and return these messages back to the application using the same format as a system error or warning message generated by SQL. In addition, the RAISERROR statement allows you to set a specific message id, level of severity, and state for the error messages.

Syntax:

RAISERROR ({ message_id | message_text | @local_variable }

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IN-LAB

Q1. Create a table ‘emp_data_labtrig’ with the columns ‘eno’, ‘ename’, ‘job’, ‘hire_day’ and ‘salary’ and insert the following data:

‘eno’ is the primary key.

ENO	ENAME	JOB	HIRE_DAY	SALARY
23	Jay	CEO	22	100000
34	May	CTO	14	100500
45	Kay	CFO	02	300000

Sol)

1. create table emp_data_labtrig (eno int, ename varchar(40), job varchar(40), hire_day number, salary int, primary key(eno));

2. INSERT INTO EMP_DATA_LABTRIG VALUES(23, 'JAY', 'CEO', 22, 100000);

3. INSERT INTO EMP_DATA_LABTRIG VALUES(34, 'MAY', 'CTO', 14, 100500);

4. INSERT INTO EMP_DATA_LABTRIG VALUES(45, 'KAY', 'CFO', 02, 300000);

5. INSERT INTO EMP_DATA_LABTRIG VALUES(31154, 'SIVARAMAKRISHNA', 'CIO', 12, 500000);

```
SQL> CONNECT System/root;
Connected.
SQL> CREATE TABLE emp_data_labtrig(eno INT, ename VARCHAR(40), job VARCHAR(40), hire_da

Table created.

SQL> INSERT INTO emp_data_labtrig VALUES(23, 'Jay', 'CEO', 22, 100000);

1 row created.

SQL> INSERT INTO emp_data_labtrig VALUES(34, 'May', 'CTO', 14, 100500);

1 row created.

SQL> INSERT INTO emp_data_labtrig VALUES(45, 'Kay', 'CFO', 02, 300000);

1 row created.

SQL> INSERT INTO emp_data_labtrig VALUES(31154, 'SivaRamaKrishna', 'CIO', 12, 500000);

1 row created.

SQL>
```

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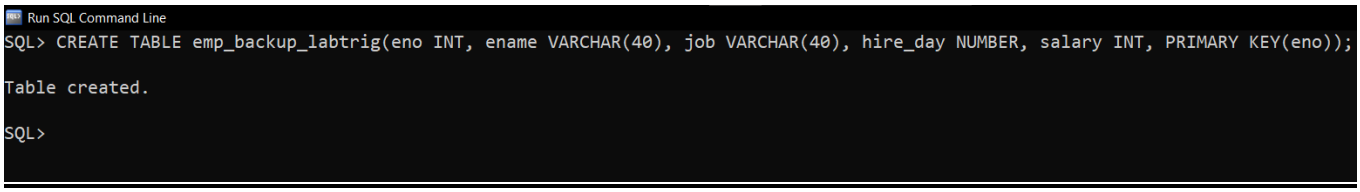
Q2. Create a table called ‘emp_backup_labtrig’ with the same columns as ‘emp_data_labtrig’. Then create a trigger ‘labtrig’ which will work before deletion in ‘emp_data_labtrig’ table and create a copy of the record to be deleted in the table ‘emp_backup_labtrig’.

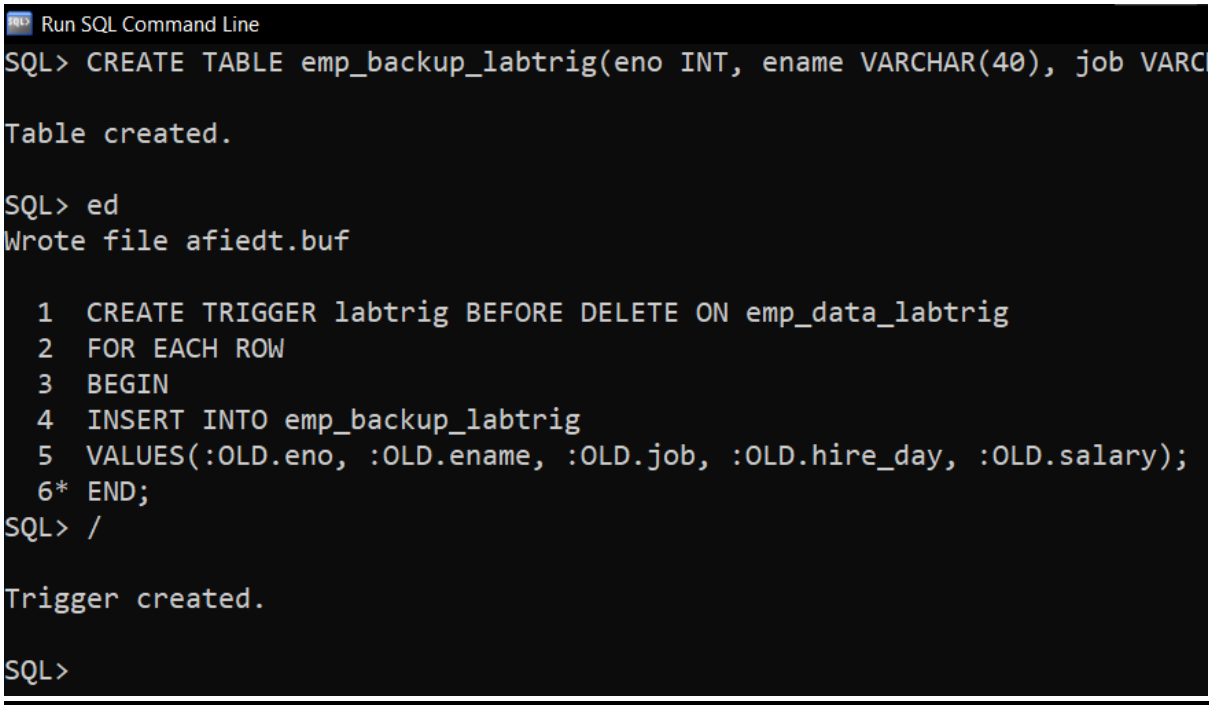
Sol) 1. Connect to system and create the table ‘emp_backup_labtrig’

create table emp_backup_labtrig (eno int, ename varchar(40), job varchar(40), hire_day number, salary int, primary key(eno));



2. Type ‘ed’ in command line and create the trigger ‘labtrig’. Then press ‘ALT+F+X’ and save when prompted. Then type ‘/’ (slash) in the command line.

CREATE TRIGGER labtrig BEFORE DELETE ON emp_data_labtrig FOR EACH ROW BEGIN INSERT INTO emp_backup_labtrig VALUES (:OLD.eno, :OLD.ename, :OLD.job, :OLD.hire_day, :OLD.salary); END;



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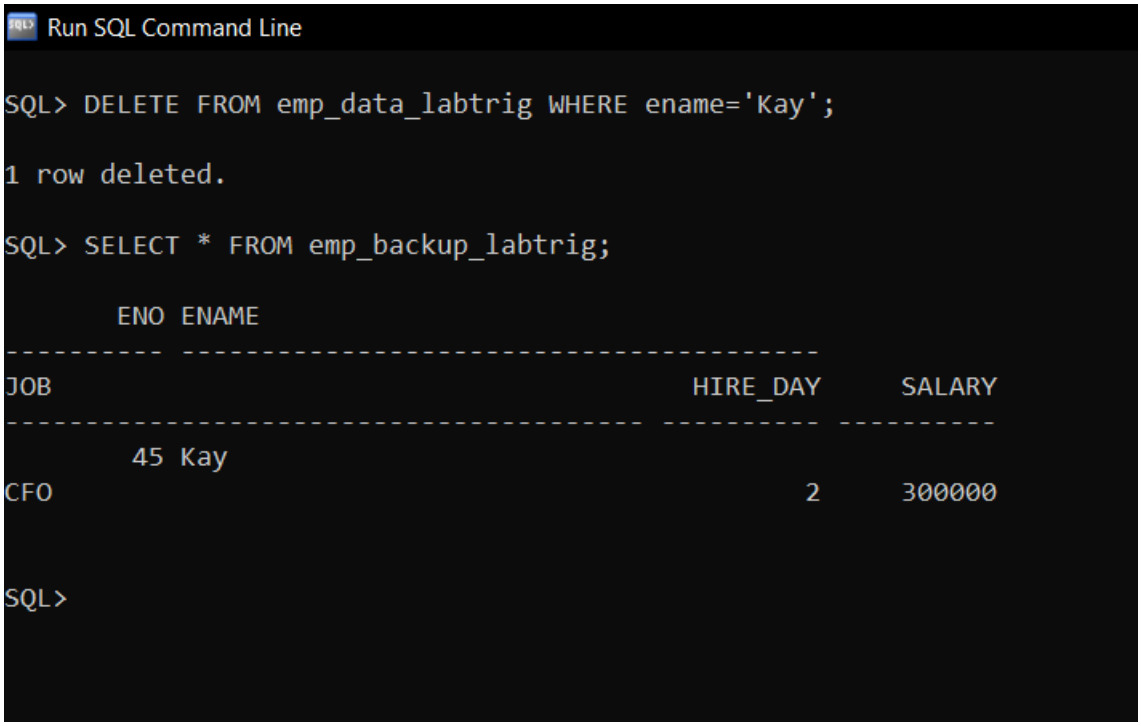
Q3. Fire the trigger ‘labtrig’ and test whether it works by deleting the row where the employee name is ‘Kay’ and check the ‘emp_backup_labtrig’ table and write the output.

Sol) 1. Delete the required row. delete from emp_data_labtrig where ename='Kay'



Q4. Create a table ‘rest_table’ and create a trigger ‘restrictions’ that does not let a user change the content of the table during working hours (8 am to 6 pm) and during a Thursday or a Friday.

ENO	ENAME	JOB
23	Jay	CEO

Sol) 1. Connect using system account with ‘connect system/system’.

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2. Create the table ‘rest_table’. create table rest_table(eno int, ename varchar(40), job varchar(40), primary key(eno)); insert into rest_table values(23, 'Jay', 'CEO');

```
Run SQL Command Line

SQL> CREATE TABLE rest_table(eno INT, ename VARCHAR(40), job VARCHAR(40), PRIMARY KEY(eno));

Table created.

SQL> INSERT INTO rest_table VALUES(23, 'Jay', 'CEO');

1 row created.

SQL>
```

3. Type ‘ed’ in command line and create the trigger ‘restrictions’.

4. The trigger is now created.

```
Run SQL Command Line
SQL> ed
Wrote file afiedt.buf

  1  CREATE OR REPLACE TRIGGER restrictions
  2      BEFORE
  3      DELETE OR INSERT ON System.rest_table
  4      DECLARE
  5          dummy INTEGER;
  6      BEGIN
  7  /* IF TODAY IS A THURSDAY OR FRIDAY, THEN RETURN AN ERROR.*/
  8    IF (TO_CHAR(SYSDATE, 'DY') = 'THU' OR
  9           TO_CHAR(SYSDATE, 'DY') = 'FRI')
 10      THEN raise_application_error( -20501, 'May not change the rest_table today');
 11      END IF;
 12  /*IF THE CURRENT TIME IS AFTER 8:00 AM OR BEFORE 6:00PM, THEN RETURN AN ERROR.*/
 13  IF (TO_CHAR(SYSDATE, 'HH24') > 8 OR TO_CHAR(SYSDATE, 'HH24') <= 18)
 14         THEN raise_application_error( -20502, 'May not change the rest_table table after working hours');
 15         END IF;
 16* END;
SQL> /

Trigger created.

SQL>
```

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Q5. Test the trigger by trying to delete the row where employee name is ‘Jay’ and write the output.

```
SQL> DELETE FROM rest_table WHERE ename='Jay';
DELETE FROM rest_table WHERE ename='Jay'
            *
ERROR at line 1:
ORA-20501: May not change the rest_table today
ORA-06512: at "SYSTEM.RESTRICTIONS", line 7
ORA-04088: error during execution of trigger 'SYSTEM.RESTRICTIONS'


SQL>
```

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POST LAB

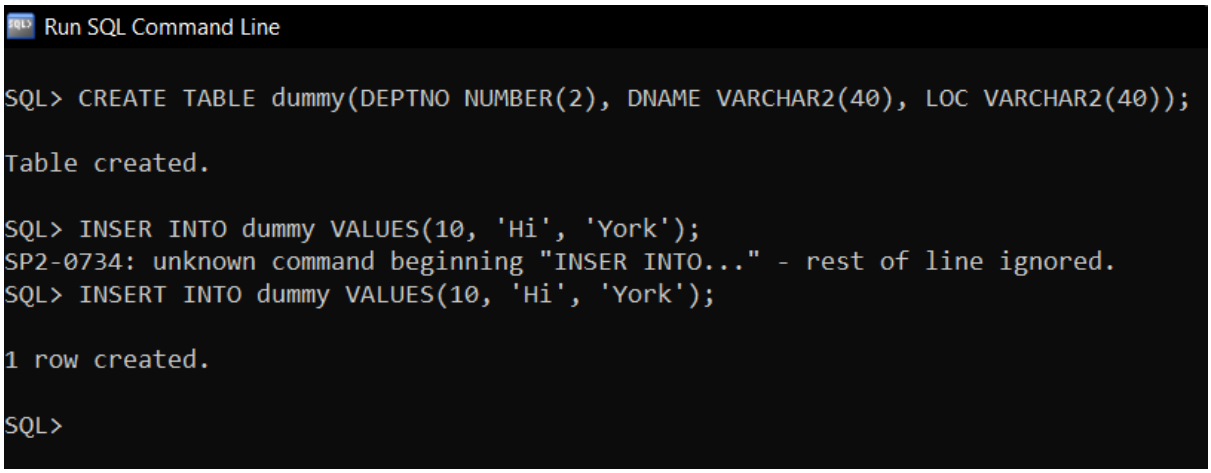
Post-Lab:

Q1. Create a table ‘dummy’.

DEPTNO	DNAME	LOC
10	Hi	York

Sol) CREATE TABLE dummy(DEPTNO NUMBER(2), DNAME VARCHAR2(14), LOC VARCHAR2(13));

insert into dummy values (10, 'Hi', 'York')



Q2. Create a trigger ‘restrict_dummy’ on update/delete that will turn the attempted operation around and reject it.

Sol) 1. Type ‘ed’ in command line and create the trigger ‘restrict_dummy’.

CREATE OR REPLACE TRIGGER restrict_dummy

BEFORE UPDATE OR DELETE

ON dummy FOR EACH ROW

BEGIN RAISE_APPLICATION_ERROR(-20001,'Cannot UPDATE or DELETE Records in dummy.');

END;

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3. Type '/' (slash) and the trigger is created.

Run SQL Command Line

```
SQL> ed
Wrote file afiedt.buf

  1  CREATE OR REPLACE TRIGGER restrict_dummy
  2  BEFORE UPDATE OR DELETE
  3  ON dummy
  4  FOR EACH ROW
  5  BEGIN
  6     RAISE_APPLICATION_ERROR(-20001,'CANNOT UPDATE OR DELETE RECORDS IN DUMMY.');
  7* END;
SQL> /

Trigger created.

SQL>
```

Q3. Test the trigger 'restrict_dummy' by updating the record where LOC is York to New and write the output.

Sol) update dummy set loc='New' where loc='York'

```
SQL> UPDATE dummy SET LOC='New' WHERE LOC='York';
UPDATE dummy SET LOC='New' WHERE LOC='York'
       *
ERROR at line 1:
ORA-20001: CANNOT UPDATE OR DELETE RECORDS IN DUMMY.
ORA-06512: at "SYSTEM.RESTRICT_DUMMY", line 2
ORA-04088: error during execution of trigger 'SYSTEM.RESTRICT_DUMMY'


SQL>
```