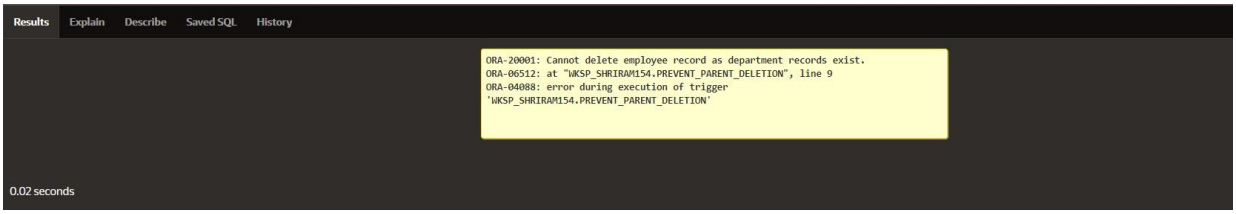
Ex.No.: 13		WORKING WITH TRIGGERS
Date:	20/09/2024	

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 prevent_parent_deletion
BEFORE DELETE ON employees
FOR EACH ROW
DECLARE pl_dept_count
NUMBER; BEGIN
   SELECT COUNT(*)
   INTO pl_dept_count
   FROM department
   WHERE dept_id = :OLD.employee_id;
   IF pl_dept_count > 0 THEN
      RAISE_APPLICATION_ERROR(-20001, 'Cannot delete employee record as
department records exist.'); END IF; END;
```

```
DELETE FROM employees
WHERE employee_id = 70;
```



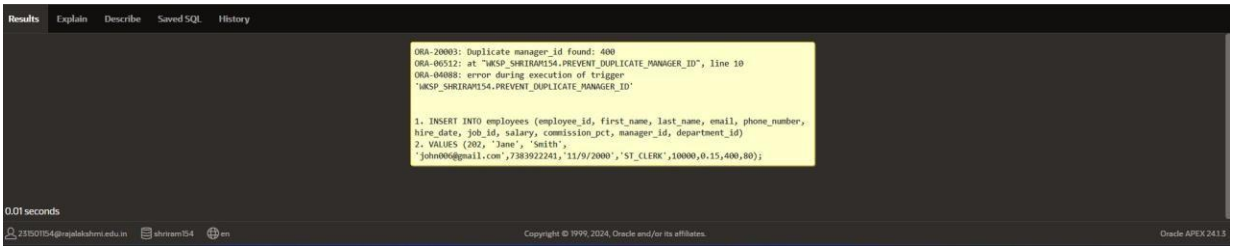
Program 2

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 prevent_duplicate_manager_id
BEFORE INSERT OR UPDATE ON employees
FOR EACH ROW
DECLARE pl_count
NUMBER; BEGIN
   SELECT COUNT(*)
   INTO pl_count
   FROM employees
   WHERE manager_id = :NEW.manager_id
   AND employee_id != :NEW.employee_id;
```

```
   IF pl_count > 0 THEN
      RAISE_APPLICATION_ERROR(-20003, 'Duplicate manager_id found: ' ||
:NEW.manager_id); END
   IF;
END;
```

```
INSERT INTO employees (employee_id, first_name, last_name, email, phone_number,
hire_date, job_id, salary, commission_pct, manager_id, department_id)
VALUES (202, 'Jane', 'Smith',
'john006@gmail.com',7383922241,'11/9/2000','ST_CLERK',10000,0.15,400,80);
```



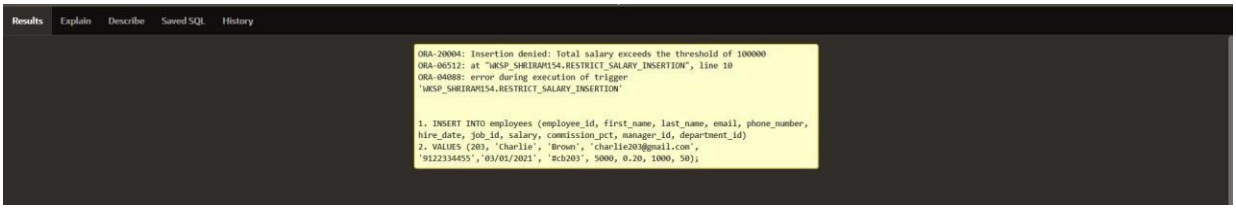
Program 3

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 restrict_salary_insertion
BEFORE INSERT ON employees
FOR EACH ROW
DECLARE
   total_salary NUMBER;
   threshold NUMBER := 100000;
BEGIN

   SELECT SUM(salary)
   INTO total_salary
   FROM employees;
   IF (total_salary + :NEW.salary) > threshold THEN
      RAISE_APPLICATION_ERROR(-20004, 'Insertion denied: Total salary exceeds the
threshold of ' || threshold); END IF;
END;
```

```
INSERT INTO employees (employee_id, first_name, last_name, email, phone_number,
hire_date, job_id, salary, commission_pct, manager_id, department_id)
```

```
VALUES (203, 'Charlie', 'Brown', 'charlie203@gmail.com', '9122334455','03/01/2021',
'#cb203', 5000, 0.20, 1000, 50);
```



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 OR REPLACE TRIGGER audit_changes
AFTER UPDATE OF salary, job_id ON employees
FOR EACH ROW
BEGIN
   IF :OLD.salary != :NEW.salary OR :OLD.job_id != :NEW.job_id THEN
      INSERT INTO employee_audit (
         employee_id, old_salary,
         new_salary, old_job_title,
         new_job_title,
         change_timestamp,
         changed_by
      ) VALUES (
         :OLD.employee_id,
         :OLD.salary,
         :NEW.salary,
         :OLD.job_id,
         :NEW.job_id,
         SYSTIMESTAMP,
         USER
      );
   END IF;
END;


UPDATE employees
SET salary = 55000, job_id = 'ST_CLERK'
WHERE employee_id = 176;
```

```
SELECT * FROM employee_audit;
```

AUDIT_ID	EMPLOYEE_ID	OLD_SALARY	NEW_SALARY	OLD_JOB_ID	NEW_JOB_ID	CHANGE_TIMESTAMP	CHANGED_BY
1	20	50000	55000	manager	manager	15-OCT-24 10.00.00.000000 AM	admin
2	122	60000	65000	Manager	Manager	15-OCT-24 10.15.00.000000 AM	admin
5	27	45000	47000	Analyst	Senior Analyst	15-OCT-24 10.30.00.000000 AM	user1
22	176	7500	55000	#ce005	ST_CLERK	16-OCT-24 04.25.06.252580 PM	APEX_PUBLIC_USER
3	9	70000	75000	Senior Developer	Lead Developer	15-OCT-24 10.45.00.000000 AM	user2
4	4	80000	85000	Team Lead	Project Manager	15-OCT-24 11.00.00.000000 AM	admin

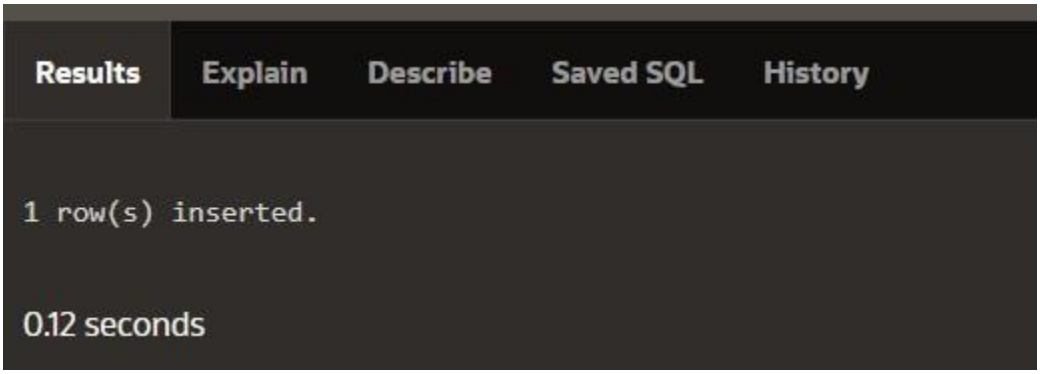
6 rows returned in 0.00 seconds Download

PROGRAM 5

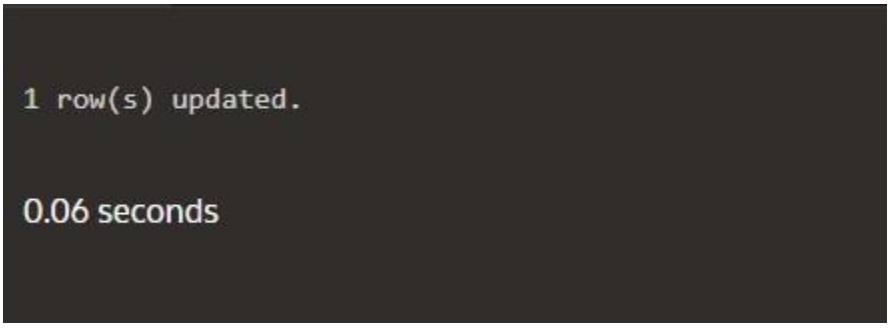
Write a code in PL/SQL to implement a trigger that records user activity (inserts, updates, deletes) in an audit log for a given set of tables.

```
CREATE OR REPLACE TRIGGER trg_audit_employees
AFTER INSERT OR UPDATE OR DELETE ON employees
FOR EACH ROW DECLARE
   v_old_values CLOB; v_new_values
   CLOB;
BEGIN
   IF INSERTING THEN
      v_old_values := NULL;
      v_new_values := 'employee_id: ' || :NEW.employee_id || ', ' ||
                  'first_name: ' || :NEW.first_name || ', ' ||
                  'salary: ' || :NEW.salary;

      INSERT INTO audit_log (action, table_name, record_id, changed_by, new_values)
      VALUES ('INSERT', 'employees', :NEW.employee_id, USER, v_new_values);

   ELSIF UPDATING THEN
      v_old_values := 'employee_id: ' || :OLD.employee_id || ', ' ||
                  'first_name: ' || :OLD.first_name || ', ' ||
                  'salary: ' || :OLD.salary;
      v_new_values := 'employee_id: ' || :NEW.employee_id || ', ' ||
                  'first_name: ' || :NEW.first_name || ', ' ||
                  'salary: ' || :NEW.salary;

      INSERT INTO audit_log (action, table_name, record_id, changed_by, old_values,
new_values)
      VALUES ('UPDATE', 'employees', :NEW.employee_id, USER, v_old_values,
v_new_values);

   ELSIF DELETING THEN
      v_old_values := 'employee_id: ' || :OLD.employee_id || ', ' ||
                  'first_name: ' || :OLD.first_name || ', ' ||
                  'salary: ' || :OLD.salary;
      v_new_values := NULL;
```

```
        INSERT INTO audit_log (action, table_name, record_id, changed_by, old_values)
        VALUES ('DELETE', 'employees', :OLD.employee_id, USER, v_old_values);
    END IF;
END trg_audit_employees;
INSERT INTO employees (employee_id, first_name, salary) VALUES
(3, 'Ball', 50000);
```




```
UPDATE employees
SET salary = 55000 WHERE
employee_id = 3;
```




```
DELETE FROM employees
WHERE employee_id = 3;

SELECT * FROM audit_log;
```

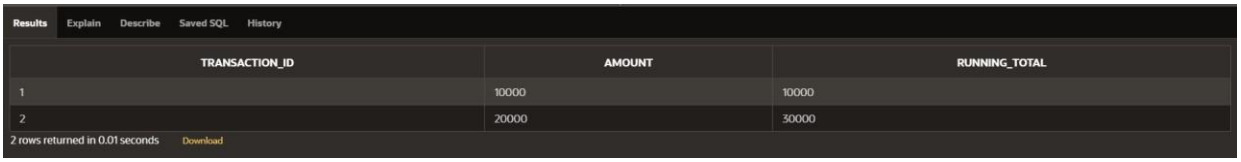
AUDIT_ID	ACTION	TABLE_NAME	RECORD_ID	CHANGED_BY	CHANGE_TIMESTAMP	OLD_VALUES	NEW_VALUES
1	INSERT	employees	3	APEX_PUBLIC_USER	16-OCT-24 04.39.17.957308 PM	-	employee_id: 3, first_name: Ball, salary: 50000
3	DELETE	employees	3	APEX_PUBLIC_USER	16-OCT-24 04.41.49.077471 PM	employee_id: 3, first_name: Ball, salary: 55000	-
2	UPDATE	employees	3	APEX_PUBLIC_USER	16-OCT-24 04.40.03.193035 PM	employee_id: 3, first_name: Ball, salary: 50000	employee_id: 3, first_name: Ball, salary: 55000

3 rows returned in 0.00 seconds Download

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 transactions ( transaction_id
   NUMBER PRIMARY KEY,
   amount NUMBER,
   running_total NUMBER
);
CREATE OR REPLACE TRIGGER update_running_total
FOR INSERT ON transactions COMPOUND
TRIGGER

   TYPE amount_array IS TABLE OF NUMBER INDEX BY PLS_INTEGER; new_amounts
   amount_array;

   BEFORE EACH ROW IS
   BEGIN new_amounts(:NEW.transaction_id) :=
   :NEW.amount; END BEFORE EACH ROW;

   AFTER STATEMENT IS
   BEGIN
      DECLARE v_total
         NUMBER;
      BEGIN
         SELECT NVL(MAX(running_total), 0)
         INTO v_total FROM
         transactions;

         FOR i IN new_amounts.FIRST .. new_amounts.LAST LOOP v_total
            := v_total + new_amounts(i);
            UPDATE transactions
            SET running_total = v_total
            WHERE transaction_id = i;
         END LOOP;
      END;
   END AFTER STATEMENT;

END update_running_total;


INSERT INTO transactions (transaction_id, amount)
VALUES (1, 10000);


INSERT INTO transactions (transaction_id, amount)
VALUES (2, 20000);
```



Results | Explain | Describe | Saved SQL | History

TRANSACTION_ID	AMOUNT	RUNNING_TOTAL
1	10000	10000
2	20000	30000

2 rows returned in 0.01 seconds Download

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 TABLE inventory ( item_id
   NUMBER      PRIMARY      KEY,
   item_name      VARCHAR2(100),
   stock_level NUMBER
```

```
);
```

```
CREATE TABLE orders ( order_id
   NUMBER PRIMARY KEY, item_id
   NUMBER,    quantity    NUMBER,
   order_status VARCHAR2(20),
   CONSTRAINT fk_item FOREIGN KEY (item_id) REFERENCES inventory(item_id)
);
```

```
CREATE OR REPLACE TRIGGER validate_stock_before_order
BEFORE INSERT ON orders
FOR EACH ROW
DECLARE v_stock_level
   NUMBER; v_pending_orders
   NUMBER;
BEGIN
   SELECT stock_level
   INTO v_stock_level
   FROM inventory
   WHERE item_id = :NEW.item_id;
   SELECT NVL(SUM(quantity), 0)
   INTO v_pending_orders
   FROM orders
   WHERE item_id = :NEW.item_id AND
    order_status = 'Pending';
   IF (:NEW.quantity + v_pending_orders) > v_stock_level THEN
      RAISE_APPLICATION_ERROR(-20001, 'Insufficient stock for item: ' || :NEW.item_id);
   END IF;
END;
INSERT INTO orders (order_id, item_id, quantity, order_status) VALUES
(1, 101, 5, 'Pending');
```

```
1 row(s) inserted.

0.03 seconds
```

```
INSERT INTO orders (order_id, item_id, quantity, order_status) VALUES
(2, 103, 20, 'Pending');
```

```
ORA-20001: Insufficient stock for item: 103
ORA-06512: at "WKSP_SHRIRAM154.VALIDATE_STOCK_BEFORE_ORDER", line 15
ORA-04088: error during execution of trigger
'WKSP_SHRIRAM154.VALIDATE_STOCK_BEFORE_ORDER'


1. INSERT INTO orders (order_id, item_id, quantity, order_status)
2. VALUES (2, 103, 20, 'Pending');
```

ITEM_ID	ITEM_NAME	STOCK_LEVEL
101	hp_laptop	10
102	keyboard	20
103	mouse	15

rows returned in 0.01 seconds Download

ORDER_ID	ITEM_ID	QUANTITY	ORDER_STATUS
1	101	5	Pending

1 rows returned in 0.01 seconds Download