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Ex.No:13 **Roll No:231901046**

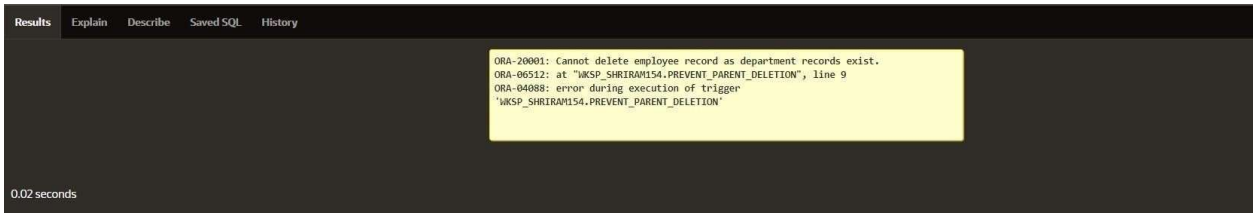
WORKING WITH TRIGGER

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;
```

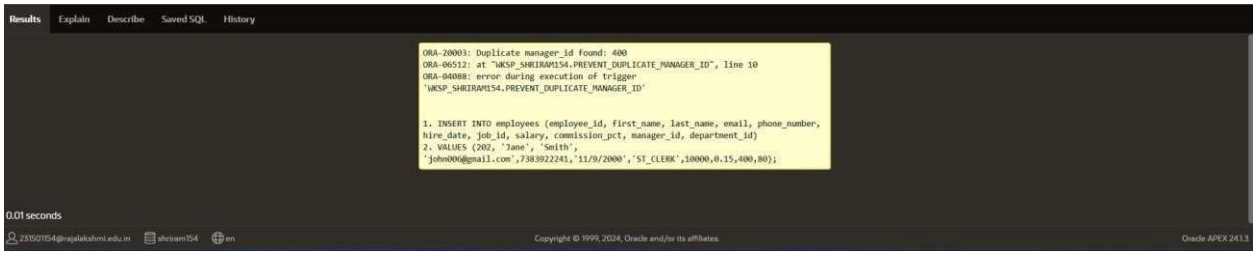


Program 2

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);
```

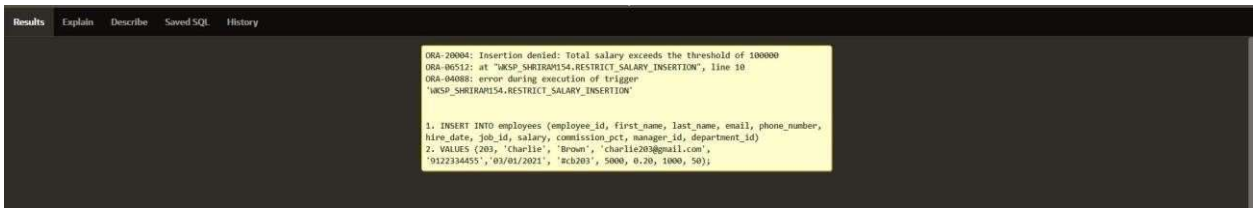


Program 3

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;
```

Program 5

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

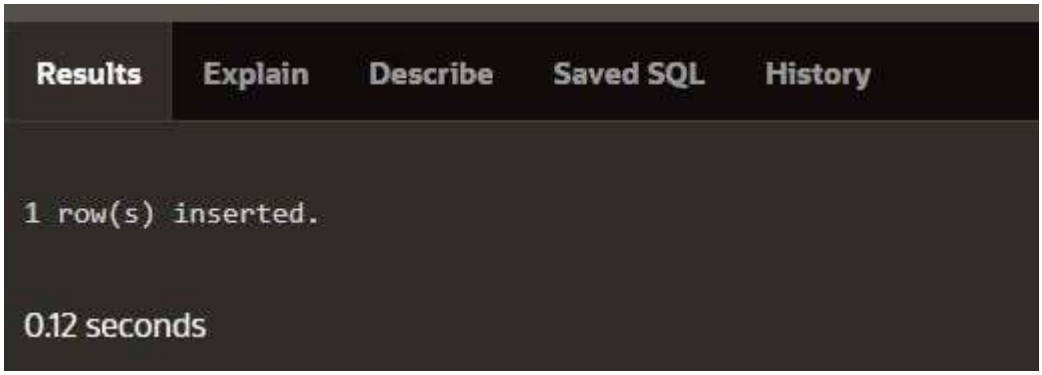
6 rows returned in 0.00 seconds Download

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;
```

```
1 row(s) updated.

0.06 seconds
```

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

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

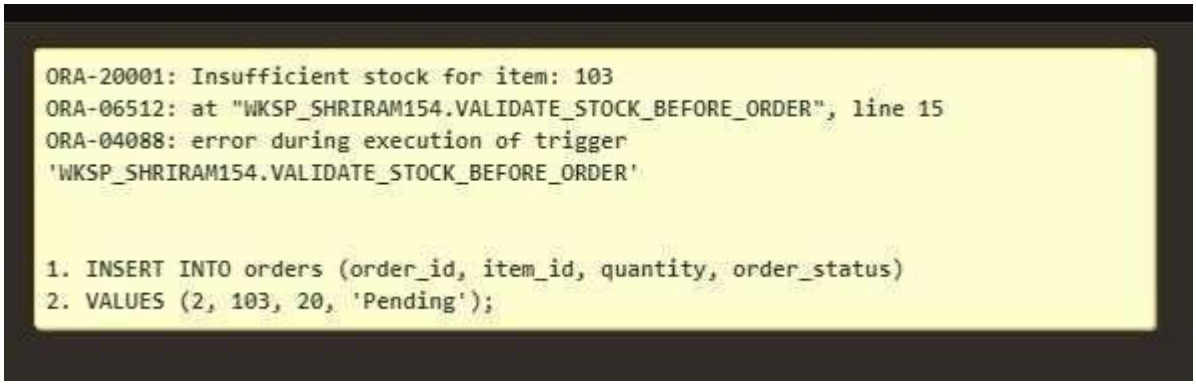
Program 7

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
```

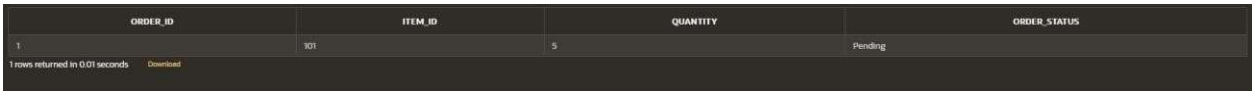
```
    FROM orders
    WHERE item_id = :NEW.item_id
      AND order_status = 'Pending';
    IF (:NEW.quantity + v_pending_orders) > v_stock_level THEN
       RAISE_APPLICATION_ERROR(-20001, 'Insufficient stock for item: ' || :NEW.item_id);
    END IF;
END;
INSERT INTO orders (order_id, item_id, quantity, order_status) VALUES (1, 101,
5, 'Pending');
```


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



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

3 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