

Ex.No.: 13	WORKING WITH TRIGGERS
Date: 10/09/2024	

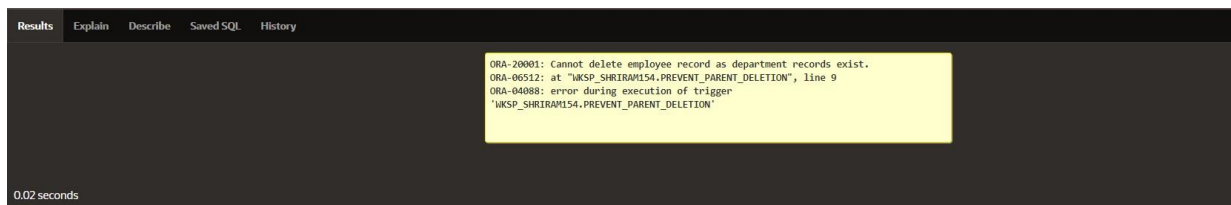
Program 1

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;
```

```

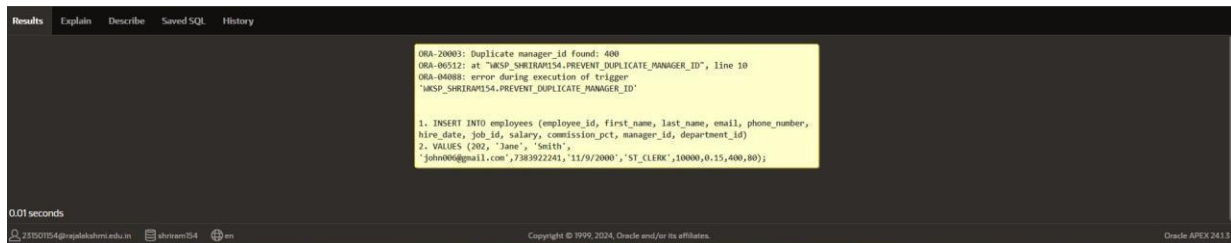
IF pl_count > 0 THEN
    RAISE_APPLICATION_ERROR(-20003, 'Duplicate manager_id found: ' ||
:NEW.manager_id); END
IF;
END;

```

```

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;

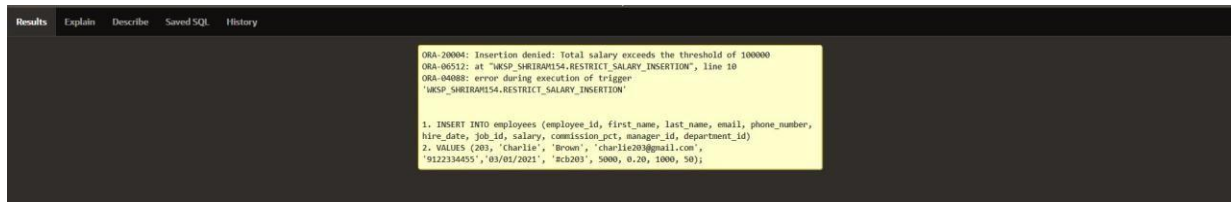
```

```

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);

A screenshot of an Oracle SQL Developer window. The window has a dark background with a light-colored text area. The text area displays an error message: "ORA-20004: Insertion denied: Total salary exceeds the threshold of 100000". Below this, it says "ORA-00512: at 'WKSP_SHRIRAM154.RESTRICT_SALARY_INSERTION', line 10" and "ORA-04088: error during execution of trigger". The trigger name is "WKSP_SHRIRAM154.RESTRICT_SALARY_INSERTION". At the bottom, the SQL statement being executed is shown: "1. INSERT INTO employees (employee_id, first_name, last_name, email, phone_number, hire_date, job_id, salary, commission_pct, manager_id, department_id) 2. VALUES (203, 'Charlie', 'Brown', 'charlie203@gmail.com', '9122334455', '03/01/2021', 'B5203', 5000, 0.20, 1000, 50);". The window has tabs for "Results", "Explain", "Describe", "Saved SQL", and "History".

```
ORA-20004: Insertion denied: Total salary exceeds the threshold of 100000
ORA-00512: at 'WKSP_SHRIRAM154.RESTRICT_SALARY_INSERTION', line 10
ORA-04088: error during execution of trigger
'WKSP_SHRIRAM154.RESTRICT_SALARY_INSERTION'

1. INSERT INTO employees (employee_id, first_name, last_name, email, phone_number,
hire_date, job_id, salary, commission_pct, manager_id, department_id)
2. VALUES (203, 'Charlie', 'Brown', 'charlie203@gmail.com',
'9122334455', '03/01/2021', 'B5203', 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);

```

Results	Explain	Describe	Saved SQL	History
1 row(s) inserted.				
0.12 seconds				

```

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 04:39:37:957308 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

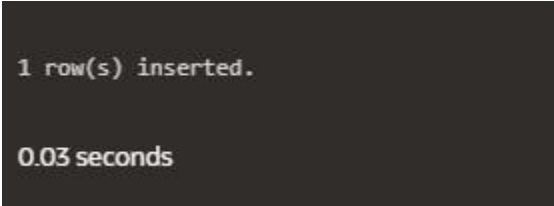
Write a code in PL/SQL to create a trigger that validates the availability of items before allowing an order to be placed, considering stock levels and pending orders.

```
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](#)