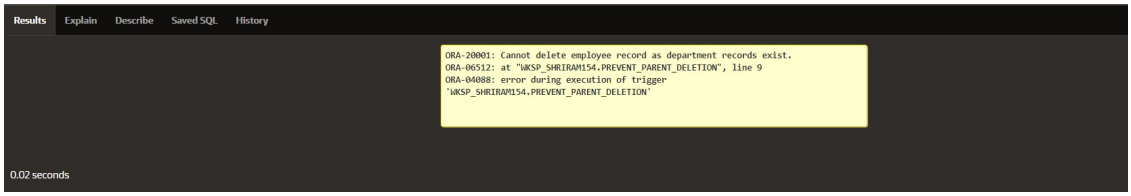
Ex.No.: 13		WORKING WITH TRIGGERS
Date:	08/10/2024	

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;
```

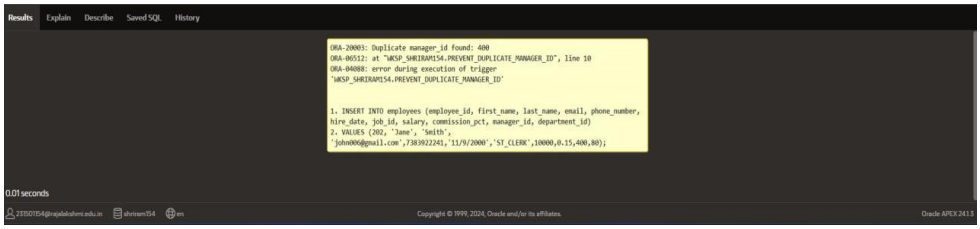


Program 2

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;
```

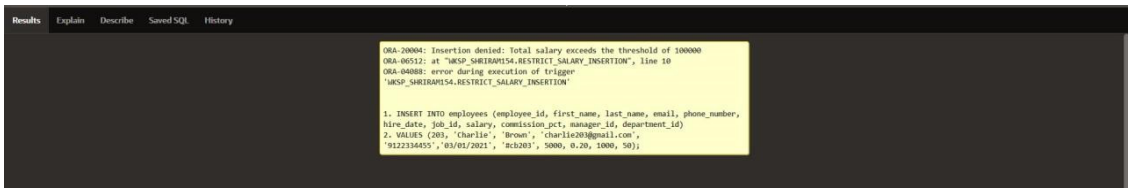
```
IF pl_count > 0 THEN
RAISE_APPLICATION_ERROR(-20003, 'Duplicate manager_id found: ' ||
:NEW.manager_id); END IF;
END;

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;
```

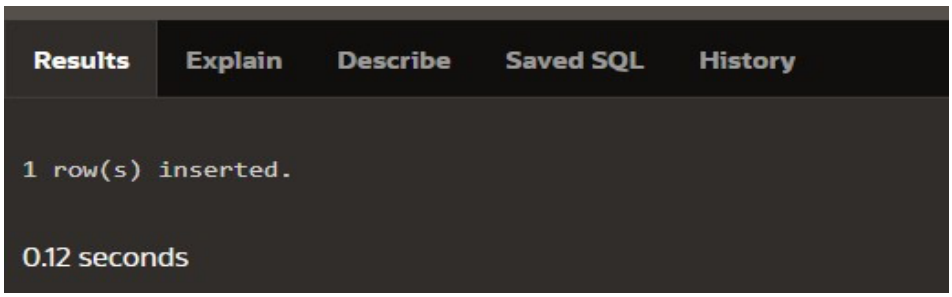
AUDIT_ID	EMPLOYEE_ID	OLD_SALARY	NEW_SALARY	OLD_JOB_ID	NEW_JOB_ID	CHANGE_TIMESTAMP	CHANGED_BY
1	20	50000	55000	manager	manager	15-OCT-24 10.00.00.000000 AM	admin
2	122	60000	65000	Manager	Manager	15-OCT-24 10.15.00.000000 AM	admin
5	27	45000	47000	Analyst	Senior Analyst	15-OCT-24 10.30.00.000000 AM	user1
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;
```

```
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

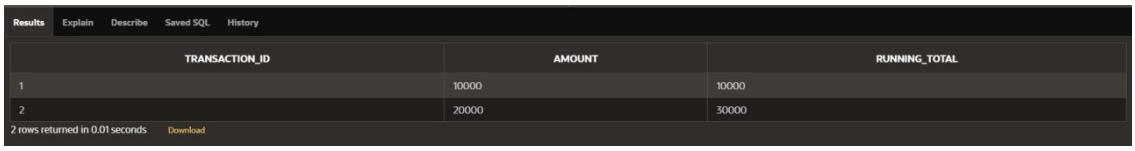
3 rows returned in 0.00 seconds Download

PROGRAM 6

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

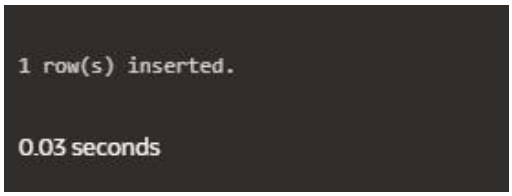
2 rows returned in 0.01 seconds Download

PROGRAM 7

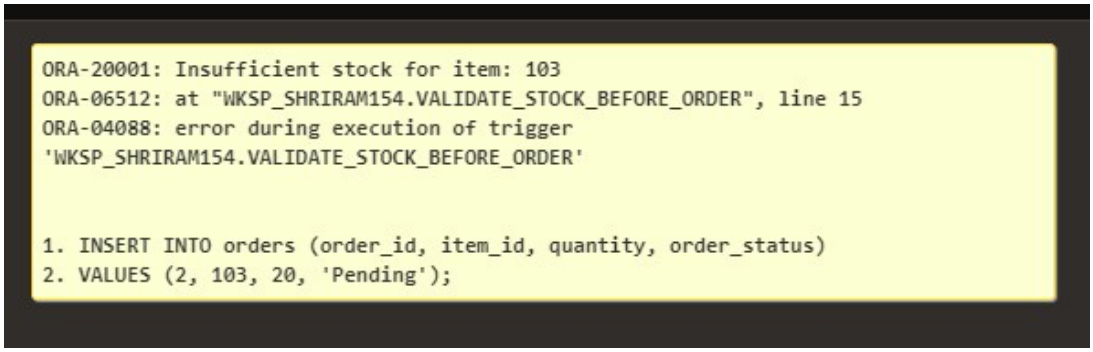
Write a code in PL/SQL to create a trigger that validates the availability of items before allowing an order to be placed, considering stock levels and pending orders.

```
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');
```




```
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