

# Assignment - 3

## SAVEETHA SCHOOL OF ENGINEERING

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Submitted to

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Course Code: **CSA0556**

Course Name: **Database Management Systems for Relational Database**

## Question 1: Handling Division Operation

**Task:**

Write a PL/SQL block to perform a division operation where the divisor is obtained from user input. Handle the `ZERO\_DIVIDE` exception gracefully with an appropriate error message.

## PL/SQL Block:

DECLARE

dividend NUMBER := 50; -- Example dividend

divisor NUMBER := 0;

result NUMBER;

BEGIN

-- Perform division

result := dividend / divisor;

DBMS\_OUTPUT.PUT\_LINE('Result: ' || result);

EXCEPTION

WHEN ZERO\_DIVIDE THEN

DBMS\_OUTPUT.PUT\_LINE('Error: Division by zero is not allowed.');

END;

## /Explanation of Error Handling Strategies:

* The `ZERO\_DIVIDE` exception is specifically caught to handle cases where the divisor is zero, preventing the program from crashing and providing a user-friendly message.
* The `WHEN OTHERS` exception handler is a catch-all for any unexpected errors, ensuring that the program gracefully handles any unforeseen issues.

## Question 2: Updating Rows with FORALL Task:

Use the `FORALL` statement to update multiple rows in the Employees table based on arrays of employee IDs and salary increments.

## PL/SQL Block:

DECLARE

TYPE emp\_id\_array IS TABLE OF NUMBER INDEX BY PLS\_INTEGER;

TYPE salary\_increment\_array IS TABLE OF NUMBER INDEX BY PLS\_INTEGER;

emp\_ids emp\_id\_array;

salary\_increments salary\_increment\_array;

BEGIN

emp\_ids(1) := 101;

emp\_ids(2) := 102;

emp\_ids(3) := 103;

salary\_increments(1) := 500;

salary\_increments(2) := 1000;

salary\_increments(3) := 750;

FORALL i IN emp\_ids.FIRST .. emp\_ids.LAST

UPDATE Employees

SET salary = salary + salary\_increments(i)

WHERE employee\_id = emp\_ids(i);

DBMS\_OUTPUT.PUT\_LINE('Salaries updated successfully.');

EXCEPTION

WHEN OTHERS THEN

DBMS\_OUTPUT.PUT\_LINE('Error: ' || SQLERRM);

END;

## Description of How FORALL Improves Performance:

* The `FORALL` statement allows for bulk binding, which reduces context switching between the PL/SQL and SQL engines. This leads to significant performance improvements when updating or inserting large numbers of rows.

## Question 3: Implementing Nested Table Procedure Task:

Implement a PL/SQL procedure that accepts a department ID as input, retrieves employees belonging to the department, stores them in a nested table type, and returns this collection as an output parameter.

## PL/SQL Block:

## CREATE OR REPLACE TYPE EmployeeRecord AS OBJECT (

## employee\_id NUMBER,

## first\_name VARCHAR2(50),

## last\_name VARCHAR2(50),

## salary NUMBER

## );

## CREATE OR REPLACE TYPE EmployeeTable AS TABLE OF EmployeeRecord;

## -- Step 2: Create the procedure to retrieve employees by department ID

## CREATE OR REPLACE PROCEDURE GetEmployeesByDepartment (

## p\_department\_id IN NUMBER,

## p\_employees OUT EmployeeTable

## ) AS

## BEGIN

## -- Initialize the nested table

## p\_employees := EmployeeTable();

## -- Retrieve employees belonging to the specified department

## SELECT EmployeeRecord(employee\_id, first\_name, last\_name, salary)

## BULK COLLECT INTO p\_employees

## FROM Employees

## WHERE department\_id = p\_department\_id;

## -- Check if any employees were found

## IF p\_employees.COUNT = 0 THEN

## DBMS\_OUTPUT.PUT\_LINE('No employees found for department ID ' || p\_department\_id);

## END IF;

## EXCEPTION

## WHEN OTHERS THEN

## DBMS\_OUTPUT.PUT\_LINE('Error: ' || SQLERRM);

## END;

## Explanation of How Nested Tables Are Utilized:

* Nested tables are used to store collections of employee records, allowing for complex data structures within PL/SQL. This procedure retrieves and stores employee data in a nested table type and returns it as an output parameter, enabling the caller to access the data in a structured format.

## Question 4: Using Cursor Variables and Dynamic SQL Task:

Write a PL/SQL block demonstrating the use of cursor variables (REF CURSOR) and dynamic SQL. Declare a cursor variable for querying `EmployeeID`, `FirstName`, and

`LastName` based on a specified salary threshold.

## PL/SQL Block:

DECLARE

TYPE ref\_cursor IS REF CURSOR;

emp\_cursor ref\_cursor;

query\_string VARCHAR2(200);

threshold\_salary NUMBER := 50000; -- Example salary threshold

emp\_id Employees.employee\_id%TYPE;

first\_name Employees.first\_name%TYPE;

last\_name Employees.last\_name%TYPE;

BEGIN

-- Construct the dynamic SQL query

query\_string := 'SELECT employee\_id, first\_name, last\_name FROM Employees WHERE salary > :threshold';

-- Open the cursor variable with the dynamic SQL query

OPEN emp\_cursor FOR query\_string USING threshold\_salary;

-- Fetch and display the results

LOOP

FETCH emp\_cursor INTO emp\_id, first\_name, last\_name;

EXIT WHEN emp\_cursor%NOTFOUND;

DBMS\_OUTPUT.PUT\_LINE('EmployeeID: ' || emp\_id || ', FirstName: ' || first\_name || ', LastName: ' || last\_name);

END LOOP;

CLOSE emp\_cursor;

EXCEPTION

WHEN OTHERS THEN

DBMS\_OUTPUT.PUT\_LINE('Error: ' || SQLERRM);

IF emp\_cursor%ISOPEN THEN

CLOSE emp\_cursor;

END IF;

END;

OPEN emp\_cur FOR 'SELECT EmployeeID, FirstName, LastName FROM Employees WHERE Salary > ' || salary\_threshold;

### LOOP

FETCH emp\_cur INTO emp\_record; EXIT WHEN emp\_cur%NOTFOUND;

DBMS\_OUTPUT.PUT\_LINE('EmployeeID: ' || emp\_record.EmployeeID || ', Name: ' || emp\_record.FirstName || ' ' || emp\_record.LastName);

### END LOOP;

CLOSE emp\_cur; EXCEPTION

### WHEN OTHERS THEN

DBMS\_OUTPUT.PUT\_LINE('An error occurred: ' || SQLERRM); END;

## Explanation of Dynamic SQL:

* Dynamic SQL is constructed at runtime, allowing for flexibility in building SQL statements based on variable conditions. In this block, a cursor variable (`EmpCurType`) is used with dynamic SQL to fetch records from the `Employees` table where the salary exceeds a specified threshold.

## Question 5: Designing Pipelined Function for Sales Data Task:

Design a pipelined PL/SQL function `get\_sales\_data` that retrieves sales data for a given month and year. The function should return a table of records containing `OrderID`,

`CustomerID`, and `OrderAmount` for orders placed in the specified month and year.

## PL/SQL Block:

-- Step 1: Define the record type and table type

CREATE OR REPLACE TYPE SalesRecord AS OBJECT (

OrderID NUMBER,

CustomerID NUMBER,

OrderAmount NUMBER

);

CREATE OR REPLACE TYPE SalesRecordTable AS TABLE OF SalesRecord;

-- Step 2: Create the pipelined function

CREATE OR REPLACE FUNCTION get\_sales\_data (p\_month IN NUMBER, p\_year IN NUMBER)

RETURN SalesRecordTable PIPELINED

IS

CURSOR sales\_cur IS

SELECT OrderID, CustomerID, OrderAmount

FROM Orders

WHERE EXTRACT(MONTH FROM OrderDate) = p\_month

AND EXTRACT(YEAR FROM OrderDate) = p\_year;

sales\_rec SalesRecord;

BEGIN

OPEN sales\_cur;

LOOP

FETCH sales\_cur INTO sales\_rec.OrderID, sales\_rec.CustomerID, sales\_rec.OrderAmount;

EXIT WHEN sales\_cur%NOTFOUND;

PIPE ROW(sales\_rec);

END LOOP;

CLOSE sales\_cur;

RETURN;

EXCEPTION

WHEN OTHERS THEN

IF sales\_cur%ISOPEN THEN

CLOSE sales\_cur;

END IF;

RAISE;

END;

## Explanation of Pipelined Table Functions:

* Pipelined functions allow for row-by-row processing and immediate returning of rows to the client as they are produced. This reduces memory consumption and improves response

times for large datasets, as rows are processed and sent incrementally rather than in a single batch.

Each solution is crafted with a focus on clarity, efficiency, and handling edge cases, ensuring that the PL/SQL code is robust and maintainable.

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