**Exercise 1: Control Structures**

**Scenario 1:** The bank wants to apply a discount to loan interest rates for customers above 60 years old.

* + **Question:** Write a PL/SQL block that loops through all customers, checks their age, and if they are above 60, apply a 1% discount to their current loan interest rates.

**Code:**

CREATE TABLE Customers (

CustomerID NUMBER PRIMARY KEY,

Name VARCHAR2(100),

DOB DATE,

Balance NUMBER,

LastModified DATE

);

INSERT INTO Customers (CustomerID, Name, DOB, Balance, LastModified)

VALUES (1, 'John Doe', TO\_DATE('1985-05-15', 'YYYY-MM-DD'), 1000, SYSDATE);

INSERT INTO Customers (CustomerID, Name, DOB, Balance, LastModified)

VALUES (2, 'Jane Smith', TO\_DATE('1990-07-20', 'YYYY-MM-DD'), 1500, SYSDATE);

ALTER TABLE Customers ADD loan\_interest\_rate NUMBER;

UPDATE Customers SET loan\_interest\_rate = 5 WHERE CustomerID = 1;

UPDATE Customers SET loan\_interest\_rate = 4.5 WHERE CustomerID = 2;

BEGIN

FOR rec IN (SELECT CustomerID, TRUNC(MONTHS\_BETWEEN(SYSDATE, DOB) / 12)

AS age, loan\_interest\_rate FROM Customers)

LOOP

IF rec.age > 60 THEN

UPDATE Customers

SET loan\_interest\_rate = loan\_interest\_rate - 1

WHERE CustomerID = rec.CustomerID;

END IF;

END LOOP;

COMMIT;

END;

/

SELECT \* FROM Customers;

**Scenario 2:** A customer can be promoted to VIP status based on their balance.

* + **Question:** Write a PL/SQL block that iterates through all customers and sets a flag IsVIP to TRUE for those with a balance over $10,000.

**Code:**

CREATE TABLE Accounts (

AccountID NUMBER PRIMARY KEY,

CustomerID NUMBER,

AccountType VARCHAR2(20),

Balance NUMBER,

LastModified DATE,

FOREIGN KEY (CustomerID) REFERENCES Customers(CustomerID)

);

INSERT INTO Accounts (AccountID, CustomerID, AccountType, Balance, LastModified)

VALUES (1, 1, 'Savings', 1000, SYSDATE);

INSERT INTO Accounts (AccountID, CustomerID, AccountType, Balance, LastModified)

VALUES (2, 2, 'Checking', 1500, SYSDATE);

ALTER TABLE Customers ADD IsVIP VARCHAR2(5) DEFAULT 'FALSE';

BEGIN

FOR rec IN (SELECT c.CustomerID, SUM(a.Balance) AS total\_balance

FROM Customers c

JOIN Accounts a ON c.CustomerID = a.CustomerID

GROUP BY c.CustomerID)

LOOP

IF rec.total\_balance > 10000 THEN

UPDATE Customers

SET IsVIP = 'TRUE'

WHERE CustomerID = rec.CustomerID;

END IF;

END LOOP;

COMMIT;

END;

/

SELECT \* FROM Customers;

**Scenario 3:** The bank wants to send reminders to customers whose loans are due within the next 30 days.

* + **Question:** Write a PL/SQL block that fetches all loans due in the next 30 days and prints a reminder message for each customer.

**Code:**

CREATE TABLE Loans (

LoanID NUMBER PRIMARY KEY,

CustomerID NUMBER,

LoanAmount NUMBER,

InterestRate NUMBER,

StartDate DATE,

EndDate DATE,

FOREIGN KEY (CustomerID) REFERENCES Customers(CustomerID)

);

INSERT INTO Loans (LoanID, CustomerID, LoanAmount, InterestRate, StartDate, EndDate)

VALUES (1, 1, 5000, 5, SYSDATE, ADD\_MONTHS(SYSDATE, 60));

BEGIN

FOR rec IN (SELECT l.LoanID, c.Name, l.EndDate

FROM Loans l

JOIN Customers c ON l.CustomerID = c.CustomerID

WHERE l.EndDate BETWEEN SYSDATE AND SYSDATE + 30)

LOOP

DBMS\_OUTPUT.PUT\_LINE('Reminder: Dear ' || rec.Name ||

', your loan (Loan ID: ' || rec.LoanID ||

') is due on ' || TO\_CHAR(rec.EndDate, 'DD-MON-YYYY') ||

'. Please ensure timely payment.');

END LOOP;

END;

/

SELECT \* FROM Loans;

**Exercise 2: Error Handling**

**Scenario 1:** Handle exceptions during fund transfers between accounts.

* + **Question:** Write a stored procedure **SafeTransferFunds** that transfers funds between two accounts. Ensure that if any error occurs (e.g., insufficient funds), an appropriate error message is logged and the transaction is rolled back.

**Code:**

CREATE TABLE Transactions (

TransactionID NUMBER PRIMARY KEY,

AccountID NUMBER,

TransactionDate DATE,

Amount NUMBER,

TransactionType VARCHAR2(10),

FOREIGN KEY (AccountID) REFERENCES Accounts(AccountID)

);

INSERT INTO Transactions (TransactionID, AccountID, TransactionDate, Amount, TransactionType)

VALUES (1, 1, SYSDATE, 200, 'Deposit');

INSERT INTO Transactions (TransactionID, AccountID, TransactionDate, Amount, TransactionType)

VALUES (2, 2, SYSDATE, 300, 'Withdrawal');

CREATE SEQUENCE Transactions\_seq

START WITH 1

INCREMENT BY 1

NOCACHE;

CREATE OR REPLACE PROCEDURE SafeTransferFunds (

p\_from\_account\_id IN NUMBER,

p\_to\_account\_id IN NUMBER,

p\_amount IN NUMBER

)

IS

insufficient\_funds EXCEPTION;

BEGIN

-- Check if from account has enough balance

DECLARE

v\_from\_balance NUMBER;

BEGIN

SELECT Balance INTO v\_from\_balance

FROM Accounts

WHERE AccountID = p\_from\_account\_id

FOR UPDATE;

IF v\_from\_balance < p\_amount THEN

RAISE insufficient\_funds;

END IF;

END;

-- Perform the transfer

UPDATE Accounts

SET Balance = Balance - p\_amount

WHERE AccountID = p\_from\_account\_id;

UPDATE Accounts

SET Balance = Balance + p\_amount

WHERE AccountID = p\_to\_account\_id;

-- Insert transaction records

INSERT INTO Transactions (TransactionID, AccountID, TransactionDate, Amount, TransactionType)

VALUES (Transactions\_seq.NEXTVAL, p\_from\_account\_id, SYSDATE, p\_amount, 'Transfer Out');

INSERT INTO Transactions (TransactionID, AccountID, TransactionDate, Amount, TransactionType)

VALUES (Transactions\_seq.NEXTVAL, p\_to\_account\_id, SYSDATE, p\_amount, 'Transfer In');

COMMIT;

EXCEPTION

WHEN insufficient\_funds THEN

ROLLBACK;

DBMS\_OUTPUT.PUT\_LINE('Error: Insufficient funds in the source account.');

WHEN NO\_DATA\_FOUND THEN

ROLLBACK;

DBMS\_OUTPUT.PUT\_LINE('Error: Invalid account ID(s).');

WHEN OTHERS THEN

ROLLBACK;

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

END;

/

**Scenario 2:** Manage errors when updating employee salaries.

* + **Question:** Write a stored procedure **UpdateSalary** that increases the salary of an employee by a given percentage. If the employee ID does not exist, handle the exception and log an error message.

**Code:**

CREATE TABLE Employees (

EmployeeID NUMBER PRIMARY KEY,

Name VARCHAR2(100),

Position VARCHAR2(50),

Salary NUMBER,

Department VARCHAR2(50),

HireDate DATE

);

INSERT INTO Employees (EmployeeID, Name, Position, Salary, Department, HireDate)

VALUES (1, 'Alice Johnson', 'Manager', 70000, 'HR', TO\_DATE('2015-06-15', 'YYYY-MM-DD'));

INSERT INTO Employees (EmployeeID, Name, Position, Salary, Department, HireDate)

VALUES (2, 'Bob Brown', 'Developer', 60000, 'IT', TO\_DATE('2017-03-20', 'YYYY-MM-DD'));

CREATE OR REPLACE PROCEDURE UpdateSalary (

p\_employee\_id IN NUMBER,

p\_percentage IN NUMBER

)

IS

employee\_not\_found EXCEPTION;

BEGIN

-- Update the salary

UPDATE Employees

SET Salary = Salary \* (1 + p\_percentage / 100)

WHERE EmployeeID = p\_employee\_id;

-- Check if any rows were updated

IF SQL%ROWCOUNT = 0 THEN

RAISE employee\_not\_found;

END IF;

COMMIT;

EXCEPTION

WHEN employee\_not\_found THEN

ROLLBACK;

DBMS\_OUTPUT.PUT\_LINE('Error: Employee ID ' || p\_employee\_id || ' does not exist.');

WHEN OTHERS THEN

ROLLBACK;

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

END;

/

**Scenario 3:** Ensure data integrity when adding a new customer.

* + **Question:** Write a stored procedure **AddNewCustomer** that inserts a new customer into the Customers table. If a customer with the same ID already exists, handle the exception by logging an error and preventing the insertion.

**Code:**

CREATE OR REPLACE PROCEDURE AddNewCustomer (

p\_customer\_id IN NUMBER,

p\_name IN VARCHAR2,

p\_dob IN DATE,

p\_balance IN NUMBER

)

IS

customer\_exists EXCEPTION;

BEGIN

-- Attempt to insert a new customer

INSERT INTO Customers (CustomerID, Name, DOB, Balance, LastModified)

VALUES (p\_customer\_id, p\_name, p\_dob, p\_balance, SYSDATE);

COMMIT;

EXCEPTION

WHEN DUP\_VAL\_ON\_INDEX THEN

ROLLBACK;

DBMS\_OUTPUT.PUT\_LINE('Error: Customer with ID ' || p\_customer\_id || ' already exists.');

RAISE customer\_exists;

WHEN OTHERS THEN

ROLLBACK;

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

END;

/

**Exercise 3: Stored Procedures**

**Scenario 1:** The bank needs to process monthly interest for all savings accounts.

* + **Question:** Write a stored procedure **ProcessMonthlyInterest** that calculates and updates the balance of all savings accounts by applying an interest rate of 1% to the current balance.

**Code:**

CREATE OR REPLACE PROCEDURE ProcessMonthlyInterest

IS

BEGIN

-- Update the balance of all savings accounts by applying 1% interest

UPDATE Accounts

SET Balance = Balance \* 1.01,

LastModified = SYSDATE

WHERE AccountType = 'Savings';

COMMIT;

END;

/

**Scenario 2:** The bank wants to implement a bonus scheme for employees based on their performance.

* + **Question:** Write a stored procedure **UpdateEmployeeBonus** that updates the salary of employees in a given department by adding a bonus percentage passed as a parameter.

**Code:**

CREATE OR REPLACE PROCEDURE UpdateEmployeeBonus (

p\_department IN VARCHAR2,

p\_bonus\_percentage IN NUMBER

)

IS

BEGIN

-- Update the salary of employees in the specified department

UPDATE Employees

SET Salary = Salary \* (1 + p\_bonus\_percentage / 100)

WHERE Department = p\_department;

COMMIT;

END;

/

**Scenario 3:** Customers should be able to transfer funds between their accounts.

* **Question:** Write a stored procedure **TransferFunds** that transfers a specified amount from one account to another, checking that the source account has sufficient balance before making the transfer.

**Code:**

CREATE OR REPLACE PROCEDURE TransferFunds (

p\_from\_account\_id IN NUMBER,

p\_to\_account\_id IN NUMBER,

p\_amount IN NUMBER

)

IS

insufficient\_funds EXCEPTION;

v\_from\_balance NUMBER;

BEGIN

-- Check if the source account has enough balance

SELECT Balance INTO v\_from\_balance

FROM Accounts

WHERE AccountID = p\_from\_account\_id

FOR UPDATE;

IF v\_from\_balance < p\_amount THEN

RAISE insufficient\_funds;

END IF;

-- Deduct the amount from the source account

UPDATE Accounts

SET Balance = Balance - p\_amount

WHERE AccountID = p\_from\_account\_id;

-- Add the amount to the destination account

UPDATE Accounts

SET Balance = Balance + p\_amount

WHERE AccountID = p\_to\_account\_id;

-- Record the transaction for the source account

INSERT INTO Transactions (TransactionID, AccountID, TransactionDate, Amount, TransactionType)

VALUES (Transactions\_seq.NEXTVAL, p\_from\_account\_id, SYSDATE, p\_amount, 'Transfer Out');

-- Record the transaction for the destination account

INSERT INTO Transactions (TransactionID, AccountID, TransactionDate, Amount, TransactionType)

VALUES (Transactions\_seq.NEXTVAL, p\_to\_account\_id, SYSDATE, p\_amount, 'Transfer In');

-- Commit the transaction

COMMIT;

EXCEPTION

WHEN insufficient\_funds THEN

ROLLBACK;

DBMS\_OUTPUT.PUT\_LINE('Error: Insufficient funds in the source account.');

WHEN OTHERS THEN

ROLLBACK;

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

END;

/

**Exercise 4: Functions**

**Scenario 1:** Calculate the age of customers for eligibility checks.

* + **Question:** Write a function CalculateAge that takes a customer's date of birth as input and returns their age in years.

**Code:**

CREATE OR REPLACE FUNCTION CalculateAge (

p\_dob IN DATE

)

RETURN NUMBER

IS

v\_age NUMBER;

BEGIN

-- Calculate the age in years

v\_age := TRUNC(MONTHS\_BETWEEN(SYSDATE, p\_dob) / 12);

RETURN v\_age;

END;

/

**Scenario 2:** The bank needs to compute the monthly installment for a loan.

* + **Question:** Write a function **CalculateMonthlyInstallment** that takes the loan amount, interest rate, and loan duration in years as input and returns the monthly installment amount.

**Code:**

CREATE OR REPLACE FUNCTION CalculateMonthlyInstallment (

p\_loan\_amount IN NUMBER,

p\_interest\_rate IN NUMBER,

p\_loan\_duration\_years IN NUMBER

)

RETURN NUMBER

IS

v\_monthly\_installment NUMBER;

v\_monthly\_rate NUMBER;

v\_total\_payments NUMBER;

BEGIN

-- Calculate monthly interest rate

v\_monthly\_rate := p\_interest\_rate / 12 / 100;

-- Calculate total number of monthly payments

v\_total\_payments := p\_loan\_duration\_years \* 12;

-- Calculate monthly installment using the formula for an amortizing loan

v\_monthly\_installment := (p\_loan\_amount \* v\_monthly\_rate) /

(1 - POWER(1 + v\_monthly\_rate, -v\_total\_payments));

RETURN v\_monthly\_installment;

END;

/

**Scenario 3:** Check if a customer has sufficient balance before making a transaction.

* + **Question:** Write a function **HasSufficientBalance** that takes an account ID and an amount as input and returns a boolean indicating whether the account has at least the specified amount.

**Code:**

CREATE OR REPLACE FUNCTION HasSufficientBalance (

p\_account\_id IN NUMBER,

p\_amount IN NUMBER

)

RETURN BOOLEAN

IS

v\_balance NUMBER;

BEGIN

-- Retrieve the current balance of the account

SELECT Balance INTO v\_balance

FROM Accounts

WHERE AccountID = p\_account\_id;

-- Check if the balance is sufficient

IF v\_balance >= p\_amount THEN

RETURN TRUE;

ELSE

RETURN FALSE;

END IF;

EXCEPTION

WHEN NO\_DATA\_FOUND THEN

-- If no account is found, return FALSE

RETURN FALSE;

WHEN OTHERS THEN

-- Handle other unexpected errors

RETURN FALSE;

END;

/

**Exercise 5: Triggers**

**Scenario 1:** Automatically update the last modified date when a customer's record is updated.

* + **Question:** Write a trigger **UpdateCustomerLastModified** that updates the LastModified column of the Customers table to the current date whenever a customer's record is updated.

**Code:**

CREATE OR REPLACE TRIGGER UpdateCustomerLastModified

BEFORE UPDATE ON Customers

FOR EACH ROW

BEGIN

-- Update the LastModified column with the current date

:NEW.LastModified := SYSDATE;

END;

/

**Scenario 2:** Maintain an audit log for all transactions.

* + **Question:** Write a trigger **LogTransaction** that inserts a record into an AuditLog table whenever a transaction is inserted into the Transactions table.

**Code:**

CREATE TABLE AuditLog (

AuditID NUMBER PRIMARY KEY,

TransactionID NUMBER,

AccountID NUMBER,

TransactionDate DATE,

Amount NUMBER,

TransactionType VARCHAR2(10),

AuditDate DATE,

FOREIGN KEY (TransactionID) REFERENCES Transactions(TransactionID)

);

CREATE SEQUENCE AuditLog\_seq

START WITH 1

INCREMENT BY 1

NOCACHE;

CREATE OR REPLACE TRIGGER LogTransaction

AFTER INSERT ON Transactions

FOR EACH ROW

BEGIN

-- Insert a record into the AuditLog table

INSERT INTO AuditLog (

AuditID, TransactionID, AccountID, TransactionDate, Amount, TransactionType, AuditDate

) VALUES (

AuditLog\_seq.NEXTVAL, -- Using the sequence to generate the AuditID

:NEW.TransactionID,

:NEW.AccountID,

:NEW.TransactionDate,

:NEW.Amount,

:NEW.TransactionType,

SYSDATE -- The date and time the audit record was created

);

END;

/

**Scenario 3:** Enforce business rules on deposits and withdrawals.

* + **Question:** Write a trigger **CheckTransactionRules** that ensures withdrawals do not exceed the balance and deposits are positive before inserting a record into the Transactions table.

**Code:**

CREATE OR REPLACE TRIGGER CheckTransactionRules

BEFORE INSERT ON Transactions

FOR EACH ROW

DECLARE

v\_balance NUMBER;

BEGIN

-- Fetch the current balance of the account

SELECT Balance INTO v\_balance

FROM Accounts

WHERE AccountID = :NEW.AccountID

FOR UPDATE;

-- Check for withdrawals: ensure they do not exceed the balance

IF :NEW.TransactionType = 'Withdrawal' AND :NEW.Amount > v\_balance THEN

RAISE\_APPLICATION\_ERROR(-20001, 'Error: Withdrawal amount exceeds the account balance.');

END IF;

-- Check for deposits: ensure the amount is positive

IF :NEW.TransactionType = 'Deposit' AND :NEW.Amount <= 0 THEN

RAISE\_APPLICATION\_ERROR(-20002, 'Error: Deposit amount must be positive.');

END IF;

-- Check for withdrawals: ensure the amount is positive

IF :NEW.TransactionType = 'Withdrawal' AND :NEW.Amount <= 0 THEN

RAISE\_APPLICATION\_ERROR(-20003, 'Error: Withdrawal amount must be positive.');

END IF;

END;

/

**Exercise 6: Cursors**

**Scenario 1:** Generate monthly statements for all customers.

* + **Question:** Write a PL/SQL block using an explicit cursor **GenerateMonthlyStatements** that retrieves all transactions for the current month and prints a statement for each customer.

**Code:**

DECLARE

CURSOR cur\_Customers IS

SELECT c.CustomerID, c.Name

FROM Customers c;

CURSOR cur\_Transactions(p\_CustomerID NUMBER) IS

SELECT t.TransactionDate, t.Amount, t.TransactionType

FROM Transactions t

JOIN Accounts a ON t.AccountID = a.AccountID

WHERE a.CustomerID = p\_CustomerID

AND t.TransactionDate BETWEEN TRUNC(SYSDATE, 'MM') AND LAST\_DAY(SYSDATE);

v\_total\_deposits NUMBER := 0;

v\_total\_withdrawals NUMBER := 0;

BEGIN

FOR cust\_rec IN cur\_Customers LOOP

v\_total\_deposits := 0;

v\_total\_withdrawals := 0;

DBMS\_OUTPUT.PUT\_LINE('Customer: ' || cust\_rec.Name || ' (CustomerID: ' || cust\_rec.CustomerID || ')');

DBMS\_OUTPUT.PUT\_LINE('Transactions for the month:');

DBMS\_OUTPUT.PUT\_LINE('-----------------------------------');

FOR trans\_rec IN cur\_Transactions(cust\_rec.CustomerID) LOOP

IF trans\_rec.TransactionType = 'Deposit' THEN

v\_total\_deposits := v\_total\_deposits + trans\_rec.Amount;

ELSIF trans\_rec.TransactionType = 'Withdrawal' THEN

v\_total\_withdrawals := v\_total\_withdrawals + trans\_rec.Amount;

END IF;

DBMS\_OUTPUT.PUT\_LINE('Date: ' || TO\_CHAR(trans\_rec.TransactionDate, 'YYYY-MM-DD') ||

' | Type: ' || trans\_rec.TransactionType ||

' | Amount: ' || trans\_rec.Amount);

END LOOP;

DBMS\_OUTPUT.PUT\_LINE('-----------------------------------');

DBMS\_OUTPUT.PUT\_LINE('Total Deposits: ' || v\_total\_deposits);

DBMS\_OUTPUT.PUT\_LINE('Total Withdrawals: ' || v\_total\_withdrawals);

DBMS\_OUTPUT.PUT\_LINE('-----------------------------------');

DBMS\_OUTPUT.PUT\_LINE(' ');

END LOOP;

END;

/

**Scenario 2:** Apply annual fee to all accounts.

* + **Question:** Write a PL/SQL block using an explicit cursor **ApplyAnnualFee** that deducts an annual maintenance fee from the balance of all accounts.

**Code:**

DECLARE

-- Define the annual maintenance fee

v\_annual\_fee NUMBER := 50;

-- Cursor to select all accounts

CURSOR cur\_Accounts IS

SELECT AccountID, Balance

FROM Accounts

FOR UPDATE OF Balance; -- Lock the rows for update

BEGIN

-- Loop through each account

FOR acc\_rec IN cur\_Accounts LOOP

-- Deduct the annual fee from the account balance

UPDATE Accounts

SET Balance = Balance - v\_annual\_fee,

LastModified = SYSDATE

WHERE AccountID = acc\_rec.AccountID;

-- Output the result of the update

DBMS\_OUTPUT.PUT\_LINE('AccountID: ' || acc\_rec.AccountID ||

' | Old Balance: ' || acc\_rec.Balance ||

' | New Balance: ' || (acc\_rec.Balance - v\_annual\_fee));

END LOOP;

-- Commit the transaction

COMMIT;

END;

/

**Scenario 3:** Update the interest rate for all loans based on a new policy.

* + **Question:** Write a PL/SQL block using an explicit cursor **UpdateLoanInterestRates** that fetches all loans and updates their interest rates based on the new policy.

**Code:**

DECLARE

-- Define the new policy for the interest rate

v\_new\_interest\_rate NUMBER;

-- Cursor to select all loans

CURSOR cur\_Loans IS

SELECT LoanID, InterestRate

FROM Loans

FOR UPDATE OF InterestRate; -- Lock the rows for update

BEGIN

-- Assign the new interest rate as per the policy

v\_new\_interest\_rate := 4.5; -- Example: New interest rate is 4.5%

-- Loop through each loan

FOR loan\_rec IN cur\_Loans LOOP

-- Update the interest rate for the loan

UPDATE Loans

SET InterestRate = v\_new\_interest\_rate

WHERE LoanID = loan\_rec.LoanID;

-- Output the result of the update

DBMS\_OUTPUT.PUT\_LINE('LoanID: ' || loan\_rec.LoanID ||

' | Old Interest Rate: ' || loan\_rec.InterestRate ||

' | New Interest Rate: ' || v\_new\_interest\_rate);

END LOOP;

-- Commit the transaction

COMMIT;

END;

/

**Exercise 7: Packages**

**Scenario 1:** Group all customer-related procedures and functions into a package.

* + **Question:** Create a package **CustomerManagement** with procedures for adding a new customer, updating customer details, and a function to get customer balance.

**Code:**

CREATE OR REPLACE PACKAGE CustomerManagement AS

-- Procedure to add a new customer

PROCEDURE AddCustomer(

p\_customer\_id IN NUMBER,

p\_name IN VARCHAR2,

p\_dob IN DATE,

p\_balance IN NUMBER

);

-- Procedure to update customer details

PROCEDURE UpdateCustomer(

p\_customer\_id IN NUMBER,

p\_name IN VARCHAR2,

p\_dob IN DATE

);

-- Function to get customer balance

FUNCTION GetCustomerBalance(

p\_customer\_id IN NUMBER

) RETURN NUMBER;

END CustomerManagement;

/

CREATE OR REPLACE PACKAGE BODY CustomerManagement AS

-- Procedure to add a new customer

PROCEDURE AddCustomer(

p\_customer\_id IN NUMBER,

p\_name IN VARCHAR2,

p\_dob IN DATE,

p\_balance IN NUMBER

) IS

BEGIN

INSERT INTO Customers (CustomerID, Name, DOB, Balance, LastModified)

VALUES (p\_customer\_id, p\_name, p\_dob, p\_balance, SYSDATE);

DBMS\_OUTPUT.PUT\_LINE('Customer added successfully: ' || p\_name);

EXCEPTION

WHEN DUP\_VAL\_ON\_INDEX THEN

DBMS\_OUTPUT.PUT\_LINE('Error: Customer ID ' || p\_customer\_id || ' already exists.');

WHEN OTHERS THEN

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

END AddCustomer;

-- Procedure to update customer details

PROCEDURE UpdateCustomer(

p\_customer\_id IN NUMBER,

p\_name IN VARCHAR2,

p\_dob IN DATE

) IS

BEGIN

UPDATE Customers

SET Name = p\_name,

DOB = p\_dob,

LastModified = SYSDATE

WHERE CustomerID = p\_customer\_id;

IF SQL%ROWCOUNT = 0 THEN

DBMS\_OUTPUT.PUT\_LINE('Error: No customer found with ID ' || p\_customer\_id);

ELSE

DBMS\_OUTPUT.PUT\_LINE('Customer updated successfully: ' || p\_name);

END IF;

EXCEPTION

WHEN OTHERS THEN

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

END UpdateCustomer;

-- Function to get customer balance

FUNCTION GetCustomerBalance(

p\_customer\_id IN NUMBER

) RETURN NUMBER IS

v\_balance NUMBER;

BEGIN

SELECT Balance INTO v\_balance

FROM Customers

WHERE CustomerID = p\_customer\_id;

RETURN v\_balance;

EXCEPTION

WHEN NO\_DATA\_FOUND THEN

DBMS\_OUTPUT.PUT\_LINE('Error: No customer found with ID ' || p\_customer\_id);

RETURN NULL;

WHEN OTHERS THEN

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

RETURN NULL;

END GetCustomerBalance;

END CustomerManagement;

/

**Scenario 2:** Create a package to manage employee data.

* + **Question:** Write a package **EmployeeManagement** with procedures to hire new employees, update employee details, and a function to calculate annual salary.

**Code:**

CREATE OR REPLACE PACKAGE EmployeeManagement AS

-- Procedure to hire a new employee

PROCEDURE HireEmployee (

p\_employee\_id IN NUMBER,

p\_name IN VARCHAR2,

p\_position IN VARCHAR2,

p\_salary IN NUMBER,

p\_department IN VARCHAR2,

p\_hire\_date IN DATE

);

-- Procedure to update employee details

PROCEDURE UpdateEmployeeDetails (

p\_employee\_id IN NUMBER,

p\_name IN VARCHAR2,

p\_position IN VARCHAR2,

p\_salary IN NUMBER,

p\_department IN VARCHAR2

);

-- Function to calculate annual salary

FUNCTION CalculateAnnualSalary (

p\_employee\_id IN NUMBER

) RETURN NUMBER;

END EmployeeManagement;

/

CREATE OR REPLACE PACKAGE BODY EmployeeManagement AS

-- Procedure to hire a new employee

PROCEDURE HireEmployee (

p\_employee\_id IN NUMBER,

p\_name IN VARCHAR2,

p\_position IN VARCHAR2,

p\_salary IN NUMBER,

p\_department IN VARCHAR2,

p\_hire\_date IN DATE

) IS

BEGIN

INSERT INTO Employees (EmployeeID, Name, Position, Salary, Department, HireDate)

VALUES (p\_employee\_id, p\_name, p\_position, p\_salary, p\_department, p\_hire\_date);

END HireEmployee;

-- Procedure to update employee details

PROCEDURE UpdateEmployeeDetails (

p\_employee\_id IN NUMBER,

p\_name IN VARCHAR2,

p\_position IN VARCHAR2,

p\_salary IN NUMBER,

p\_department IN VARCHAR2

) IS

BEGIN

UPDATE Employees

SET Name = p\_name,

Position = p\_position,

Salary = p\_salary,

Department = p\_department

WHERE EmployeeID = p\_employee\_id;

END UpdateEmployeeDetails;

-- Function to calculate annual salary

FUNCTION CalculateAnnualSalary (

p\_employee\_id IN NUMBER

) RETURN NUMBER IS

v\_annual\_salary NUMBER;

BEGIN

SELECT Salary \* 12

INTO v\_annual\_salary

FROM Employees

WHERE EmployeeID = p\_employee\_id;

RETURN v\_annual\_salary;

END CalculateAnnualSalary;

END EmployeeManagement;

/

**Scenario 3:** Group all account-related operations into a package.

* + **Question:** Create a package **AccountOperations** with procedures for opening a new account, closing an account, and a function to get the total balance of a customer across all accounts.

**Code:**

CREATE OR REPLACE PACKAGE AccountOperations AS

-- Procedure to open a new account

PROCEDURE OpenAccount(

p\_CustomerID IN NUMBER,

p\_AccountType IN VARCHAR2,

p\_Balance IN NUMBER

);

-- Procedure to close an account

PROCEDURE CloseAccount(

p\_AccountID IN NUMBER

);

-- Function to get the total balance of a customer across all accounts

FUNCTION GetTotalBalance(

p\_CustomerID IN NUMBER

) RETURN NUMBER;

END AccountOperations;

/

CREATE SEQUENCE Accounts\_seq

START WITH 1

INCREMENT BY 1

NOCACHE

NOCYCLE;

CREATE OR REPLACE PACKAGE BODY AccountOperations AS

-- Procedure to open a new account

PROCEDURE OpenAccount(

p\_CustomerID IN NUMBER,

p\_AccountType IN VARCHAR2,

p\_Balance IN NUMBER

) IS

BEGIN

INSERT INTO Accounts (AccountID, CustomerID, AccountType, Balance, LastModified)

VALUES (Accounts\_seq.NEXTVAL, p\_CustomerID, p\_AccountType, p\_Balance, SYSDATE);

DBMS\_OUTPUT.PUT\_LINE('Account opened successfully.');

EXCEPTION

WHEN OTHERS THEN

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

END OpenAccount;

-- Procedure to close an account

PROCEDURE CloseAccount(

p\_AccountID IN NUMBER

) IS

BEGIN

DELETE FROM Accounts WHERE AccountID = p\_AccountID;

DBMS\_OUTPUT.PUT\_LINE('Account closed successfully.');

EXCEPTION

WHEN OTHERS THEN

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

END CloseAccount;

-- Function to get the total balance of a customer across all accounts

FUNCTION GetTotalBalance(

p\_CustomerID IN NUMBER

) RETURN NUMBER IS

v\_TotalBalance NUMBER := 0;

BEGIN

SELECT SUM(Balance) INTO v\_TotalBalance

FROM Accounts

WHERE CustomerID = p\_CustomerID;

RETURN v\_TotalBalance;

EXCEPTION

WHEN NO\_DATA\_FOUND THEN

RETURN 0;

WHEN OTHERS THEN

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

RETURN 0;

END GetTotalBalance;

END AccountOperations;

/