**PL SQL PROGRAMMING**

**-- Schema to be Created**

CREATE TABLE CUSTOMERS (

CUSTOMERID NUMBER PRIMARY KEY,

NAME VARCHAR2(100),

DOB DATE,

BALANCE NUMBER,

LASTMODIFIED DATE

);

CREATE TABLE ACCOUNTS (

ACCOUNTID NUMBER PRIMARY KEY,

CUSTOMERID NUMBER,

ACCOUNTTYPE VARCHAR2(20),

BALANCE NUMBER,

LASTMODIFIED DATE,

FOREIGN KEY ( CUSTOMERID )

REFERENCES CUSTOMERS ( CUSTOMERID )

);

CREATE TABLE TRANSACTIONS (

TRANSACTIONID NUMBER PRIMARY KEY,

ACCOUNTID NUMBER,

TRANSACTIONDATE DATE,

AMOUNT NUMBER,

TRANSACTIONTYPE VARCHAR2(10),

FOREIGN KEY ( ACCOUNTID )

REFERENCES ACCOUNTS ( ACCOUNTID )

);

CREATE TABLE LOANS (

LOANID NUMBER PRIMARY KEY,

CUSTOMERID NUMBER,

LOANAMOUNT NUMBER,

INTERESTRATE NUMBER,

STARTDATE DATE,

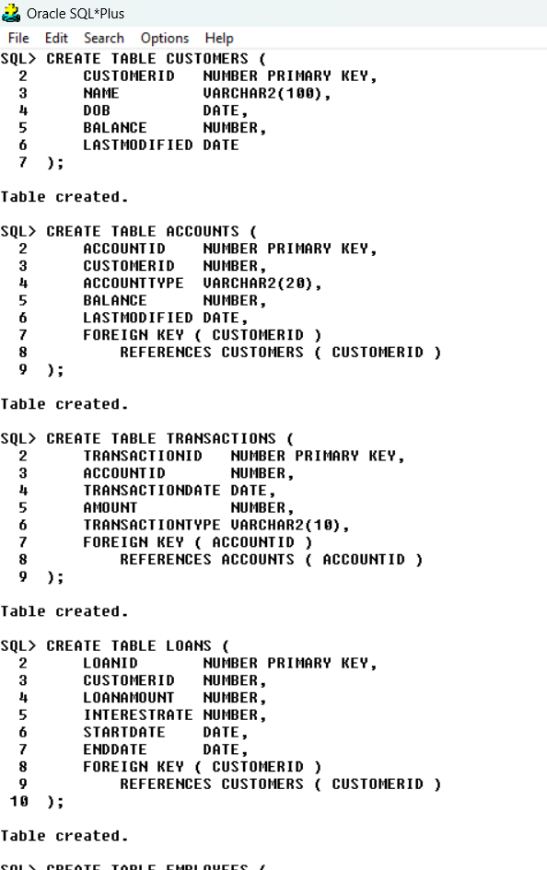
ENDDATE DATE,

FOREIGN KEY ( CUSTOMERID )

REFERENCES CUSTOMERS ( CUSTOMERID )

);

**OUTPUT:**



CREATE TABLE EMPLOYEES (

EMPLOYEEID NUMBER PRIMARY KEY,

NAME VARCHAR2(100),

POSITION VARCHAR2(50),

SALARY NUMBER,

DEPARTMENT VARCHAR2(50),

HIREDATE DATE

);

**OUTPUT:**

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**-- Example Scripts for Sample Data Insertion**

-- INSERT INTO CUSTOMERS

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);

-- INSERT INTO ACCOUNTS

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);

-- INSTER INTO TRANSACTIONS

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');

-- INSERT INTO LOANS

INSERT INTO LOANS (LOANID, CUSTOMERID, LOANAMOUNT, INTERESTRATE, STARTDATE, ENDDATE)

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

-- INSERT INTO EMPLOYEES

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'));

**OUTPUT:**

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AI-generated content may be incorrect.

**-- QUESTIONS AND SOLUTIONS**

**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.

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.

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.

**-- SCENARIO 1**

SET SERVEROUTPUT ON;

DECLARE

CURSOR CUSTOMER\_CURSOR IS

SELECT CUSTOMERID, EXTRACT(YEAR FROM SYSDATE) - EXTRACT(YEAR FROM DOB) AS AGE

FROM CUSTOMERS;

VAR\_CUSTOMER\_ID CUSTOMERS.CUSTOMERID%TYPE;

VAR\_AGE NUMBER;

BEGIN

FOR CUSTOMER\_RECORD IN CUSTOMER\_CURSOR LOOP

VAR\_CUSTOMER\_ID := CUSTOMER\_RECORD.CUSTOMERID;

VAR\_AGE := CUSTOMER\_RECORD.AGE;

IF VAR\_AGE > 60 THEN

UPDATE LOANS

SET INTERESTRATE = INTERESTRATE - 1

WHERE CUSTOMERID = VAR\_CUSTOMER\_ID;

ELSE

DBMS\_OUTPUT.PUT\_LINE('CUSTOMER WITH CUSTOMER ID : ' || VAR\_CUSTOMER\_ID || ' IS OF AGE : ' || VAR\_AGE);

DBMS\_OUTPUT.PUT\_LINE('NO CHANGE IN LOAN');

END IF;

END LOOP;

COMMIT;

END;

/

**OUTPUT:**

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**-- SCENARIO 2**

DESC CUSTOMERS;

ALTER TABLE CUSTOMERS ADD ISVIP CHAR(10) CONSTRAINT CHK1 CHECK(ISVIP IN ('TRUE','FALSE')) ;

SET SERVEROUTPUT ON;

DECLARE

CURSOR CUSTOMER\_CURSOR IS

SELECT CUSTOMERID, BALANCE

FROM CUSTOMERS;

VAR\_CUSTOMER\_ID CUSTOMERS.CUSTOMERID%TYPE;

VAR\_BALANCE CUSTOMERS.BALANCE%TYPE;

BEGIN

FOR CUSTOMER\_RECORD IN CUSTOMER\_CURSOR LOOP

VAR\_CUSTOMER\_ID := CUSTOMER\_RECORD.CUSTOMERID;

VAR\_BALANCE := CUSTOMER\_RECORD.BALANCE;

IF VAR\_BALANCE > 10000 THEN

DBMS\_OUTPUT.PUT\_LINE('CUSTOMER ID : ' || VAR\_CUSTOMER\_ID || ' HAS BALANCE GREATER THAN 10000');

UPDATE CUSTOMERS

SET ISVIP = 'TRUE'

WHERE CUSTOMERID = VAR\_CUSTOMER\_ID;

ELSE

DBMS\_OUTPUT.PUT\_LINE('CUSTOMER ID : ' || VAR\_CUSTOMER\_ID || ' HAS BALANCE LESSER THAN 10000');

UPDATE CUSTOMERS

SET ISVIP = 'FALSE'

WHERE CUSTOMERID = VAR\_CUSTOMER\_ID;

END IF;

END LOOP;

COMMIT;

END;

/

**OUTPUT:**

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**-- SCENARIO 3**

SET SERVEROUTPUT ON;

DECLARE

CURSOR CUR\_LOANS IS

SELECT L.LOANID, L.CUSTOMERID, C.NAME, L.ENDDATE

FROM LOANS L

JOIN CUSTOMERS C ON L.CUSTOMERID = C.CUSTOMERID

WHERE L.ENDDATE BETWEEN SYSDATE AND SYSDATE + 30;

V\_LOAN\_ID LOANS.LOANID%TYPE;

V\_CUSTOMER\_ID LOANS.CUSTOMERID%TYPE;

V\_CUSTOMER\_NAME CUSTOMERS.NAME%TYPE;

V\_END\_DATE LOANS.ENDDATE%TYPE;

V\_FOUND BOOLEAN := FALSE;

BEGIN

OPEN CUR\_LOANS;

LOOP

FETCH CUR\_LOANS INTO V\_LOAN\_ID, V\_CUSTOMER\_ID, V\_CUSTOMER\_NAME, V\_END\_DATE;

EXIT WHEN CUR\_LOANS%NOTFOUND;

V\_FOUND := TRUE;

DBMS\_OUTPUT.PUT\_LINE('Reminder: Loan ' || V\_LOAN\_ID || ' for customer ' || V\_CUSTOMER\_NAME || ' (ID: ' || V\_CUSTOMER\_ID || ') is due on ' || TO\_CHAR(V\_END\_DATE, 'YYYY-MM-DD'));

END LOOP;

CLOSE CUR\_LOANS;

IF NOT V\_FOUND THEN

DBMS\_OUTPUT.PUT\_LINE('No loans are due within the next 30 days.');

END IF;

END;

/

**OUTPUT:**

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**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.

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.

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.

**-- SCENARIO 1**

SET SERVEROUTPUT ON;

CREATE OR REPLACE PROCEDURE SAFETRANSFERFUNDS(

P\_FROM\_ACCOUNT\_ID IN ACCOUNTS.ACCOUNTID%TYPE,

P\_TO\_ACCOUNT\_ID IN ACCOUNTS.ACCOUNTID%TYPE,

P\_AMOUNT IN NUMBER

) AS

V\_FROM\_BALANCE ACCOUNTS.BALANCE%TYPE;

V\_TO\_BALANCE ACCOUNTS.BALANCE%TYPE;

BEGIN

SELECT BALANCE INTO V\_FROM\_BALANCE

FROM ACCOUNTS

WHERE ACCOUNTID = P\_FROM\_ACCOUNT\_ID

FOR UPDATE;

SELECT BALANCE INTO V\_TO\_BALANCE

FROM ACCOUNTS

WHERE ACCOUNTID = P\_TO\_ACCOUNT\_ID

FOR UPDATE;

-- Check for sufficient funds

IF V\_FROM\_BALANCE < P\_AMOUNT THEN

RAISE\_APPLICATION\_ERROR(-20001, 'Insufficient funds in the source account.');

END IF;

-- Perform the transfer

UPDATE ACCOUNTS

SET BALANCE = BALANCE - P\_AMOUNT,

LASTMODIFIED = SYSDATE

WHERE ACCOUNTID = P\_FROM\_ACCOUNT\_ID;

UPDATE ACCOUNTS

SET BALANCE = BALANCE + P\_AMOUNT,

LASTMODIFIED = SYSDATE

WHERE ACCOUNTID = P\_TO\_ACCOUNT\_ID;

COMMIT;

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

EXCEPTION

WHEN OTHERS THEN

ROLLBACK;

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

END SAFETRANSFERFUNDS;

/

EXEC SAFETRANSFERFUNDS(2,1,500);

**OUTPUT:**

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**-- SCENARIO 2**

SET SERVEROUTPUT ON;

CREATE OR REPLACE PROCEDURE UPDATESALARY(

P\_EMPLOYEE\_ID IN EMPLOYEES.EMPLOYEEID%TYPE,

P\_PERCENTAGE IN NUMBER

) AS

V\_OLD\_SALARY EMPLOYEES.SALARY%TYPE;

BEGIN

-- Fetch the current salary

SELECT SALARY INTO V\_OLD\_SALARY

FROM EMPLOYEES

WHERE EMPLOYEEID = P\_EMPLOYEE\_ID;

-- Update the salary

UPDATE EMPLOYEES

SET SALARY = SALARY \* (1 + P\_PERCENTAGE / 100),

HIREDATE = SYSDATE

WHERE EMPLOYEEID = P\_EMPLOYEE\_ID;

COMMIT;

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

EXCEPTION

WHEN NO\_DATA\_FOUND THEN

DBMS\_OUTPUT.PUT\_LINE('Error: Employee ID ' || P\_EMPLOYEE\_ID || ' does not exist.');

WHEN OTHERS THEN

ROLLBACK;

DBMS\_OUTPUT.PUT\_LINE('Salary update failed: ' || SQLERRM);

END UPDATESALARY;

/

EXEC UPDATESALARY(1,5);

EXEC UPDATESALARY(2,3);

**OUTPUT:**

A screenshot of a computer program

AI-generated content may be incorrect.

**-- SCENARIO 3**

SET SERVEROUTPUT ON;

CREATE OR REPLACE PROCEDURE ADDNEWCUSTOMER(

P\_CUSTOMER\_ID IN CUSTOMERS.CUSTOMERID%TYPE,

P\_NAME IN CUSTOMERS.NAME%TYPE,

P\_DOB IN CUSTOMERS.DOB%TYPE,

P\_BALANCE IN CUSTOMERS.BALANCE%TYPE

) AS

BEGIN

-- Attempt to insert the new customer

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

DBMS\_OUTPUT.PUT\_LINE('CUSTOMER\_ID : ' || P\_CUSTOMER\_ID);

DBMS\_OUTPUT.PUT\_LINE('NAME : ' || P\_NAME);

DBMS\_OUTPUT.PUT\_LINE('DOB : ' || P\_DOB);

DBMS\_OUTPUT.PUT\_LINE('BALANCE : ' || P\_BALANCE);

INSERT INTO CUSTOMERS (CUSTOMERID, NAME, DOB, BALANCE, LASTMODIFIED)

VALUES (P\_CUSTOMER\_ID, P\_NAME, TO\_DATE(P\_DOB,'YYYY-MM-DD'), P\_BALANCE, SYSDATE);

COMMIT;

DBMS\_OUTPUT.PUT\_LINE('Customer added successfully.');

EXCEPTION

WHEN DUP\_VAL\_ON\_INDEX THEN

DBMS\_OUTPUT.PUT\_LINE('Error: Customer ID ' || P\_CUSTOMER\_ID || ' already exists.');

WHEN OTHERS THEN

ROLLBACK;

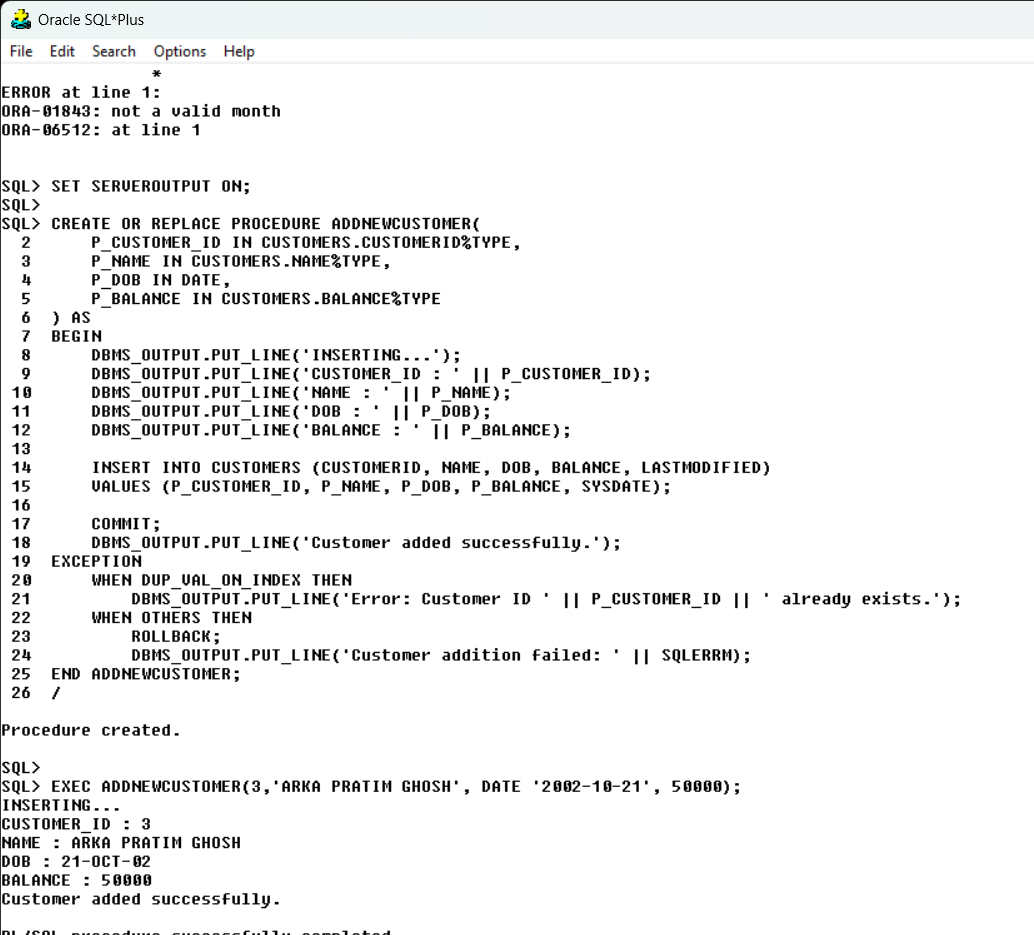
DBMS\_OUTPUT.PUT\_LINE('Customer addition failed: ' || SQLERRM);

END ADDNEWCUSTOMER;

/

EXEC ADDNEWCUSTOMER(3,'ARKA PRATIM GHOSH','21-10-2002',50000);

**OUTPUT:**



**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.

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.

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.

**-- SCENARIO 1**

SET SERVEROUTPUT ON;

CREATE OR REPLACE PROCEDURE PROCESSMONTHLYINTEREST AS

BEGIN

UPDATE ACCOUNTS

SET BALANCE = BALANCE \* 1.01,

LASTMODIFIED = SYSDATE

WHERE ACCOUNTTYPE = 'Savings';

COMMIT;

DBMS\_OUTPUT.PUT\_LINE('Monthly interest processed for all savings accounts.');

EXCEPTION

WHEN OTHERS THEN

ROLLBACK;

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

END PROCESSMONTHLYINTEREST;

/

EXEC PROCESSMONTHLYINTEREST();

**OUTPUT:**

A screenshot of a computer program

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**-- SCENARIO 2**

SET SERVEROUTPUT ON;

CREATE OR REPLACE PROCEDURE UPDATEEMPLOYEEBONUS(

P\_DEPARTMENT IN EMPLOYEES.DEPARTMENT%TYPE,

P\_BONUS\_PERCENTAGE IN NUMBER

) AS

BEGIN

UPDATE EMPLOYEES

SET SALARY = SALARY \* (1 + P\_BONUS\_PERCENTAGE / 100),

HIREDATE = SYSDATE

WHERE DEPARTMENT = P\_DEPARTMENT;

COMMIT;

DBMS\_OUTPUT.PUT\_LINE('Bonus applied to employees in the ' || P\_DEPARTMENT || ' department.');

EXCEPTION

WHEN OTHERS THEN

ROLLBACK;

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

END UPDATEEMPLOYEEBONUS;

/

EXEC UPDATEEMPLOYEEBONUS('IT',5);

EXEC UPDATEEMPLOYEEBONUS('HR',3);

**OUTPUT:**

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**-- SCENARIO 3**

SET SERVEROUTPUT ON;

CREATE OR REPLACE PROCEDURE TRANSFERFUNDS(

P\_FROM\_ACCOUNT\_ID IN ACCOUNTS.ACCOUNTID%TYPE,

P\_TO\_ACCOUNT\_ID IN ACCOUNTS.ACCOUNTID%TYPE,

P\_AMOUNT IN NUMBER

) AS

V\_FROM\_BALANCE ACCOUNTS.BALANCE%TYPE;

BEGIN

SELECT BALANCE INTO V\_FROM\_BALANCE

FROM ACCOUNTS

WHERE ACCOUNTID = P\_FROM\_ACCOUNT\_ID

FOR UPDATE;

-- Check for sufficient funds

IF V\_FROM\_BALANCE < P\_AMOUNT THEN

RAISE\_APPLICATION\_ERROR(-20001, 'Insufficient funds in the source account.');

END IF;

-- Perform the transfer

UPDATE ACCOUNTS

SET BALANCE = BALANCE - P\_AMOUNT,

LASTMODIFIED = SYSDATE

WHERE ACCOUNTID = P\_FROM\_ACCOUNT\_ID;

UPDATE ACCOUNTS

SET BALANCE = BALANCE + P\_AMOUNT,

LASTMODIFIED = SYSDATE

WHERE ACCOUNTID = P\_TO\_ACCOUNT\_ID;

COMMIT;

DBMS\_OUTPUT.PUT\_LINE('Transfer of ' || P\_AMOUNT || ' from account ' || P\_FROM\_ACCOUNT\_ID || ' to account ' || P\_TO\_ACCOUNT\_ID || ' completed successfully.');

EXCEPTION

WHEN OTHERS THEN

ROLLBACK;

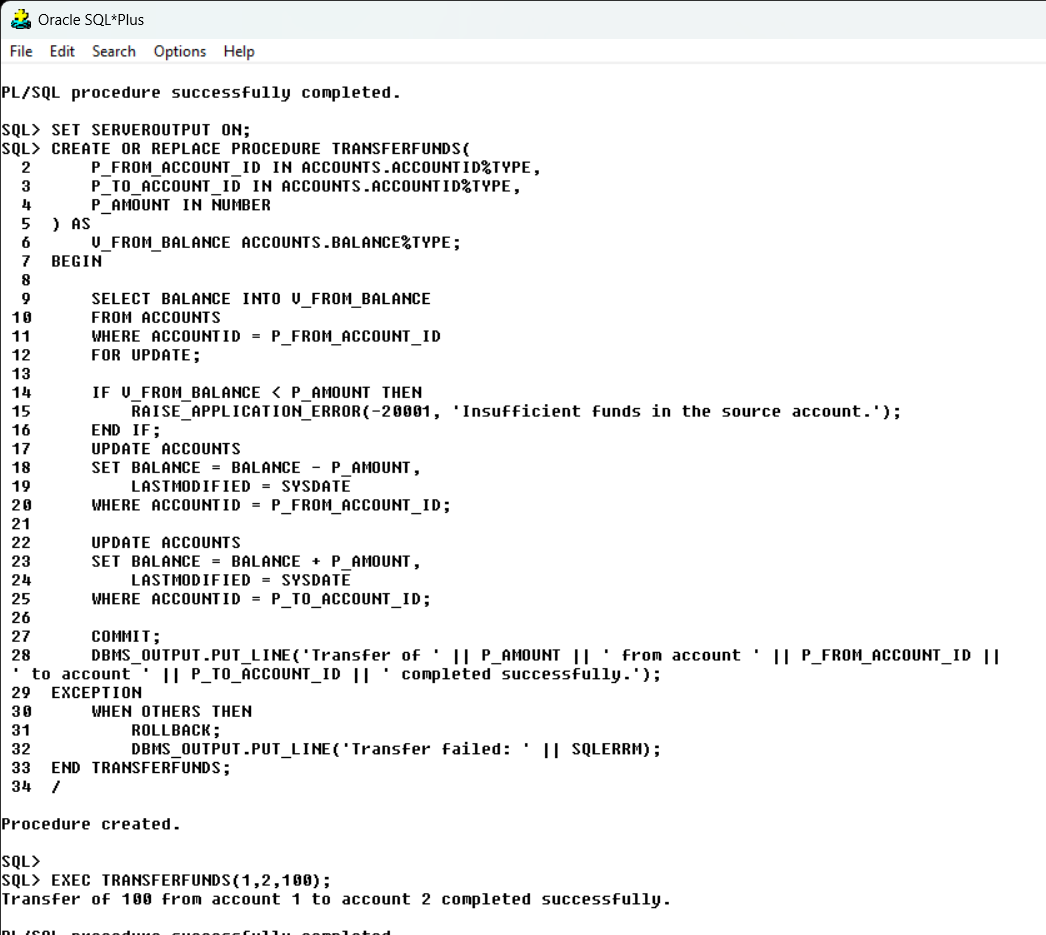
DBMS\_OUTPUT.PUT\_LINE('Transfer failed: ' || SQLERRM);

END TRANSFERFUNDS;

/

EXEC TRANSFERFUNDS(1,2,100);

**OUTPUT:**



**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.

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.

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.

**-- SCENARIO 1**

DELETE FROM CUSTOMERS WHERE CUSTOMERID = 3;

SET SERVEROUTPUT ON;

CREATE OR REPLACE FUNCTION CALCULATEAGE(

P\_DOB IN DATE

) RETURN NUMBER IS

V\_AGE NUMBER;

BEGIN

V\_AGE := TRUNC((SYSDATE - P\_DOB) / 365);

RETURN V\_AGE;

END CALCULATEAGE;

/

SET SERVEROUTPUT ON;

DECLARE

CURSOR CURSOR\_CUST IS SELECT CUSTOMERID, DOB FROM CUSTOMERS;

V\_CUSTOMERID CUSTOMERS.CUSTOMERID%TYPE;

V\_DOB CUSTOMERS.DOB%TYPE;

V\_AGE NUMBER;

BEGIN

OPEN CURSOR\_CUST;

LOOP

FETCH CURSOR\_CUST INTO V\_CUSTOMERID, V\_DOB;

EXIT WHEN CURSOR\_CUST%NOTFOUND

V\_AGE := CALCULATEAGE(V\_DOB);

DBMS\_OUTPUT.PUT\_LINE('CUSTOMER ID : ' || V\_CUSTOMERID || ' AGE : ' || V\_AGE);

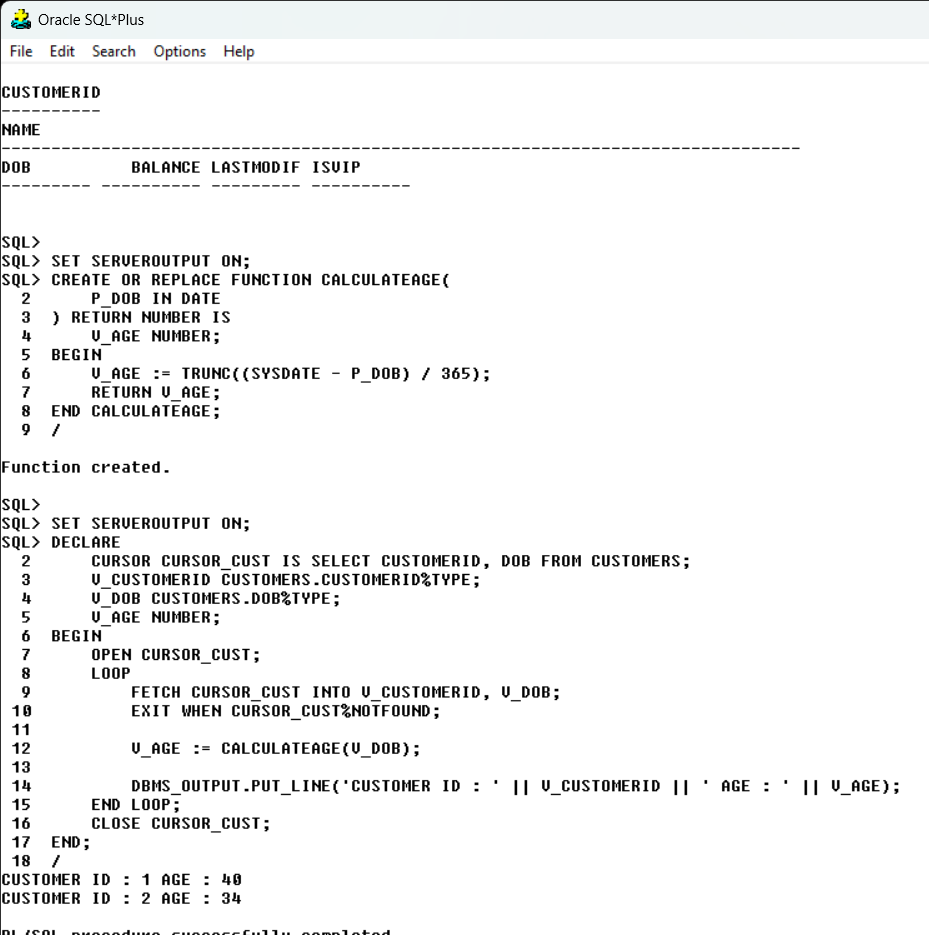
END LOOP;

CLOSE CURSOR\_CUST;

END;

/

**OUTPUT:**



**-- SCENARIO 2**

SET SERVEROUTPUT ON;

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\_RATE NUMBER;

V\_NUM\_PAYMENTS NUMBER;

V\_MONTHLY\_INSTALLMENT NUMBER;

BEGIN

V\_MONTHLY\_RATE := P\_INTEREST\_RATE / 12 / 100;

V\_NUM\_PAYMENTS := P\_LOAN\_DURATION\_YEARS \* 12;

IF V\_MONTHLY\_RATE = 0 THEN

V\_MONTHLY\_INSTALLMENT := P\_LOAN\_AMOUNT / V\_NUM\_PAYMENTS;

ELSE

V\_MONTHLY\_INSTALLMENT := P\_LOAN\_AMOUNT \* V\_MONTHLY\_RATE / (1 - POWER(1 + V\_MONTHLY\_RATE, -V\_NUM\_PAYMENTS));

END IF;

RETURN V\_MONTHLY\_INSTALLMENT;

END CALCULATEMONTHLYINSTALLMENT;

/

SET SERVEROUTPUT ON;

DECLARE

CURSOR LOAN\_CUR IS SELECT \* FROM LOANS;

V\_DATA LOANS%ROWTYPE;

V\_DURATION NUMBER;

V\_MONTHLYINSTALLMENT NUMBER;

BEGIN

OPEN LOAN\_CUR;

LOOP

FETCH LOAN\_CUR INTO V\_DATA;

EXIT WHEN LOAN\_CUR%NOTFOUND;

V\_DURATION := TRUNC((V\_DATA.ENDDATE - V\_DATA.STARTDATE)/365);

V\_MONTHLYINSTALLMENT := TRUNC(CALCULATEMONTHLYINSTALLMENT(V\_DATA.LOANAMOUNT, V\_DATA.INTERESTRATE, V\_DURATION),2);

DBMS\_OUTPUT.PUT\_LINE('CUSTOMER ID : ' || V\_DATA.CUSTOMERID || ' MONTHLY INSTALLAMENT : ' || V\_MONTHLYINSTALLMENT);

END LOOP;

CLOSE LOAN\_CUR;

END;

/

**OUTPUT:** A screenshot of a computer

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**-- SCENARIO 3**

SET SERVEROUTPUT ON;

CREATE OR REPLACE FUNCTION HASSUFFICIENTBALANCE(

P\_ACCOUNT\_ID IN ACCOUNTS.ACCOUNTID%TYPE,

P\_AMOUNT IN NUMBER

) RETURN BOOLEAN IS

V\_BALANCE ACCOUNTS.BALANCE%TYPE;

BEGIN

SELECT BALANCE INTO V\_BALANCE

FROM ACCOUNTS

WHERE ACCOUNTID = P\_ACCOUNT\_ID;

RETURN V\_BALANCE >= P\_AMOUNT;

EXCEPTION

WHEN NO\_DATA\_FOUND THEN

RETURN FALSE;

WHEN OTHERS THEN

RAISE\_APPLICATION\_ERROR(-20002, 'Error checking balance: ' || SQLERRM);

END HASSUFFICIENTBALANCE;

/

SET SERVEROUTPUT ON;

DECLARE

V\_ACCOUNTID ACCOUNTS.ACCOUNTID%TYPE := &ACCOUNTID;

V\_AMOUNT NUMBER := &AMOUNT;

V\_HAS BOOLEAN;

BEGIN

V\_HAS := HASSUFFICIENTBALANCE(V\_ACCOUNTID, V\_AMOUNT);

IF V\_HAS = TRUE THEN DBMS\_OUTPUT.PUT\_LINE(V\_ACCOUNTID || ' HAS SUFFICIENT AMOUNT');

ELSE DBMS\_OUTPUT.PUT\_LINE(V\_ACCOUNTID || ' DOES NOT HAVE SUFFICIENT AMOUNT');

END IF;

END;

/

**OUTPUT:**

A screenshot of a computer program

AI-generated content may be incorrect.

**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.

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.

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.

**-- SCENARIO 1**

SET SERVEROUTPUT ON;

CREATE OR REPLACE TRIGGER UPDATECUSTOMERLASTMODIFIED

BEFORE UPDATE ON CUSTOMERS

FOR EACH ROW

BEGIN

:NEW.LASTMODIFIED := SYSDATE;

DBMS\_OUTPUT.PUT\_LINE('LAST MODIFIED UPDATED');

END UPDATECUSTOMERLASTMODIFIED;

/

UPDATE CUSTOMERS SET NAME = 'JOHN DOE' WHERE CUSTOMERID = 1;

**OUTPUT:**

A screenshot of a computer code

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**-- SCENARIO 2**

CREATE TABLE AUDITLOG (

LOGID NUMBER PRIMARY KEY,

TRANSACTIONID NUMBER,

ACCOUNTID NUMBER,

TRANSACTIONDATE DATE,

AMOUNT NUMBER,

TRANSACTIONTYPE VARCHAR2(10),

LOGTIMESTAMP DATE DEFAULT SYSDATE

);

CREATE SEQUENCE AUDITLOG\_SEQ

START WITH 1

INCREMENT BY 1;

SET SERVEROUTPUT ON;

CREATE OR REPLACE TRIGGER LOGTRANSACTIONS

AFTER INSERT ON TRANSACTIONS

FOR EACH ROW

BEGIN

INSERT INTO AUDITLOG (LOGID, TRANSACTIONID, ACCOUNTID, TRANSACTIONDATE, AMOUNT, TRANSACTIONTYPE)

VALUES (AUDITLOG\_SEQ.NEXTVAL, :NEW.TRANSACTIONID, :NEW.ACCOUNTID, SYSDATE, :NEW.AMOUNT, :NEW.TRANSACTIONTYPE);

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

END LOGTRANSACTIONS;

/

INSERT INTO TRANSACTIONS (TRANSACTIONID, ACCOUNTID, TRANSACTIONDATE, AMOUNT, TRANSACTIONTYPE)

VALUES (6, 2, SYSDATE, 600, 'Deposit');

**OUTPUT:**

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**-- SCENARIO 3**

SET SERVEROUTPUT ON;

CREATE OR REPLACE TRIGGER CHECKTRANSACTIONRULES

BEFORE INSERT ON TRANSACTIONS

FOR EACH ROW

DECLARE

V\_BALANCE ACCOUNTS.BALANCE%TYPE;

BEGIN

-- Get the current balance of the account

SELECT BALANCE INTO V\_BALANCE

FROM ACCOUNTS

WHERE ACCOUNTID = :NEW.ACCOUNTID

FOR UPDATE;

-- Check the transaction type and validate accordingly

IF :NEW.TRANSACTIONTYPE = 'Withdrawal' THEN

IF :NEW.AMOUNT > V\_BALANCE THEN

RAISE\_APPLICATION\_ERROR(-20001, 'Insufficient balance for the withdrawal.');

END IF;

ELSIF :NEW.TRANSACTIONTYPE = 'Deposit' THEN

IF :NEW.AMOUNT <= 0 THEN

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

END IF;

ELSE

RAISE\_APPLICATION\_ERROR(-20003, 'Invalid transaction type.');

END IF;

END CHECKTRANSACTIONRULES;

/

INSERT INTO ACCOUNTS (ACCOUNTID, CUSTOMERID, ACCOUNTTYPE, BALANCE, LASTMODIFIED)

VALUES (4, 1, 'Recurring', 3500, SYSDATE);

**OUTPUT:**

A screenshot of a computer code

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**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.

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.

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.

\*/

**-- SCENARIO 1**

SET SERVEROUTPUT ON;

DECLARE

CURSOR CUR\_MONTHLY\_TRANSACTIONS IS

SELECT C.CUSTOMERID, C.NAME, T.TRANSACTIONDATE, T.AMOUNT, T.TRANSACTIONTYPE

FROM CUSTOMERS C

JOIN ACCOUNTS A ON C.CUSTOMERID = A.CUSTOMERID

JOIN TRANSACTIONS T ON A.ACCOUNTID = T.ACCOUNTID

WHERE TRUNC(T.TRANSACTIONDATE, 'MM') = TRUNC(SYSDATE, 'MM')

ORDER BY C.CUSTOMERID, T.TRANSACTIONDATE;

V\_CUSTOMER\_ID CUSTOMERS.CUSTOMERID%TYPE;

V\_CUSTOMER\_NAME CUSTOMERS.NAME%TYPE;

V\_TRANSACTION\_DATE TRANSACTIONS.TRANSACTIONDATE%TYPE;

V\_AMOUNT TRANSACTIONS.AMOUNT%TYPE;

V\_TRANSACTION\_TYPE TRANSACTIONS.TRANSACTIONTYPE%TYPE;

BEGIN

OPEN CUR\_MONTHLY\_TRANSACTIONS;

LOOP

FETCH CUR\_MONTHLY\_TRANSACTIONS INTO V\_CUSTOMER\_ID, V\_CUSTOMER\_NAME, V\_TRANSACTION\_DATE, V\_AMOUNT, V\_TRANSACTION\_TYPE;

EXIT WHEN CUR\_MONTHLY\_TRANSACTIONS%NOTFOUND;

DBMS\_OUTPUT.PUT\_LINE('Customer ID: ' || V\_CUSTOMER\_ID || ', Name: ' || V\_CUSTOMER\_NAME);

DBMS\_OUTPUT.PUT\_LINE('Transaction Date: ' || TO\_CHAR(V\_TRANSACTION\_DATE, 'YYYY-MM-DD') || ', Amount: ' || V\_AMOUNT || ', Type: ' || V\_TRANSACTION\_TYPE);

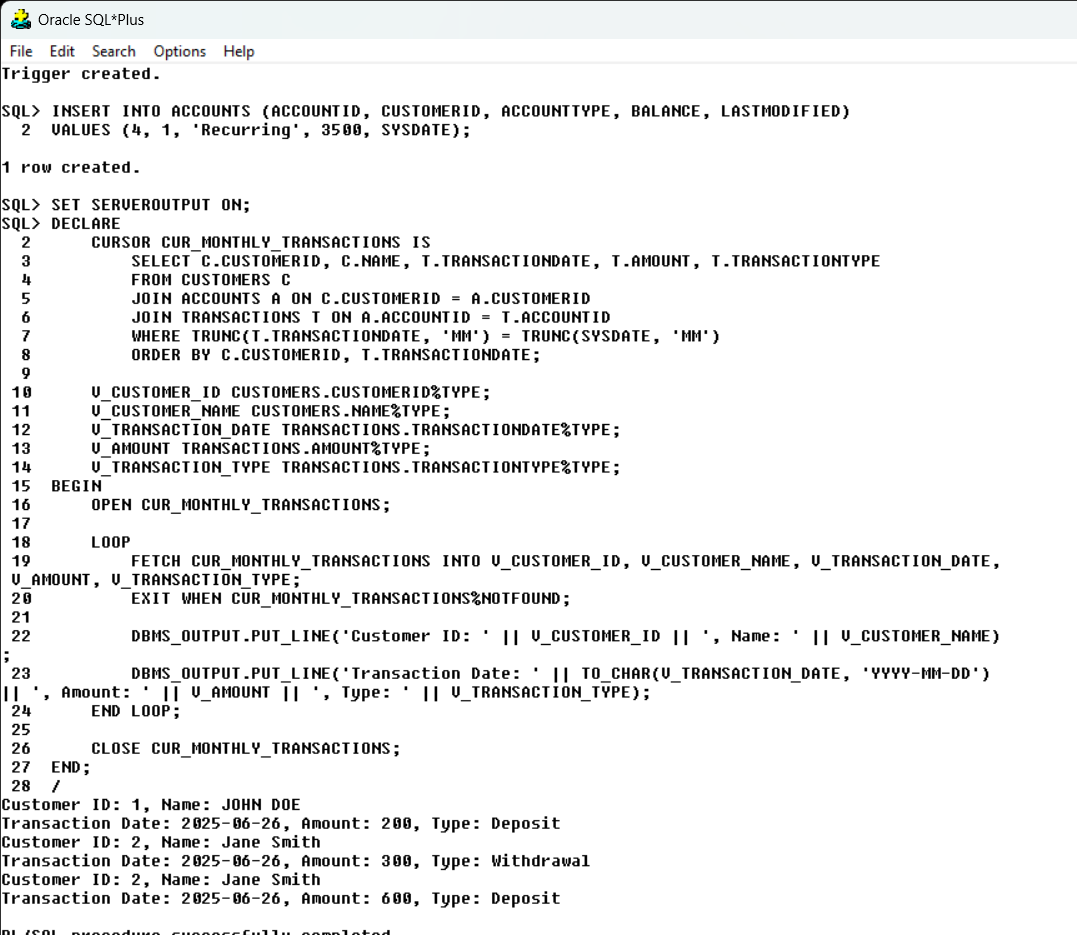
END LOOP;

CLOSE CUR\_MONTHLY\_TRANSACTIONS;

END;

/

**OUTPUT:**



**-- SCENARIO 2**

SET SERVEROUTPUT ON;

DECLARE

CURSOR CUR\_ACCOUNTS IS

SELECT ACCOUNTID, BALANCE

FROM ACCOUNTS;

V\_ACCOUNT\_ID ACCOUNTS.ACCOUNTID%TYPE;

V\_BALANCE ACCOUNTS.BALANCE%TYPE;

V\_ANNUAL\_FEE CONSTANT NUMBER := 50; -- Annual fee amount

BEGIN

OPEN CUR\_ACCOUNTS;

LOOP

FETCH CUR\_ACCOUNTS INTO V\_ACCOUNT\_ID, V\_BALANCE;

EXIT WHEN CUR\_ACCOUNTS%NOTFOUND;

UPDATE ACCOUNTS

SET BALANCE = BALANCE - V\_ANNUAL\_FEE,

LASTMODIFIED = SYSDATE

WHERE ACCOUNTID = V\_ACCOUNT\_ID;

DBMS\_OUTPUT.PUT\_LINE('Annual fee of ' || V\_ANNUAL\_FEE || ' deducted from Account ID: ' || V\_ACCOUNT\_ID);

END LOOP;

CLOSE CUR\_ACCOUNTS;

COMMIT;

END;

/

**OUTPUT:**

A screenshot of a computer screen

AI-generated content may be incorrect.

**-- SCENARIO 3**

SET SERVEROUTPUT ON;

DECLARE

CURSOR CUR\_LOANS IS

SELECT LOANID, INTERESTRATE

FROM LOANS;

V\_LOAN\_ID LOANS.LOANID%TYPE;

V\_INTEREST\_RATE LOANS.INTERESTRATE%TYPE;

V\_NEW\_INTEREST\_RATE NUMBER;

V\_NEW\_POLICY NUMBER := 2;

FUNCTION CALCULATENEWINTERESTRATE(OLD\_RATE NUMBER) RETURN NUMBER IS

BEGIN

RETURN OLD\_RATE \* (1 + (V\_NEW\_POLICY / 100));

END CALCULATENEWINTERESTRATE;

BEGIN

OPEN CUR\_LOANS;

LOOP

FETCH CUR\_LOANS INTO V\_LOAN\_ID, V\_INTEREST\_RATE;

EXIT WHEN CUR\_LOANS%NOTFOUND;

V\_NEW\_INTEREST\_RATE := CALCULATENEWINTERESTRATE(V\_INTEREST\_RATE);

UPDATE LOANS

SET INTERESTRATE = V\_NEW\_INTEREST\_RATE

WHERE LOANID = V\_LOAN\_ID;

DBMS\_OUTPUT.PUT\_LINE('Loan ID: ' || V\_LOAN\_ID || ' interest rate updated to ' || V\_NEW\_INTEREST\_RATE);

END LOOP;

CLOSE CUR\_LOANS;

COMMIT;

END;

/

**OUTPUT:**

A screenshot of a computer

AI-generated content may be incorrect.

**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.

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.

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.

**-- SCENARIO 1**

SET SERVEROUTPUT ON;

CREATE OR REPLACE PACKAGE CustomerManagement IS

PROCEDURE AddNewCustomer(

p\_customer\_id IN CUSTOMERS.CUSTOMERID%TYPE,

p\_name IN CUSTOMERS.NAME%TYPE,

p\_dob IN CUSTOMERS.DOB%TYPE,

p\_balance IN CUSTOMERS.BALANCE%TYPE

);

PROCEDURE UpdateCustomerDetails(

p\_customer\_id IN CUSTOMERS.CUSTOMERID%TYPE,

p\_name IN CUSTOMERS.NAME%TYPE,

p\_dob IN CUSTOMERS.DOB%TYPE,

p\_balance IN CUSTOMERS.BALANCE%TYPE

);

FUNCTION GetCustomerBalance(

p\_customer\_id IN CUSTOMERS.CUSTOMERID%TYPE

) RETURN CUSTOMERS.BALANCE%TYPE;

END CustomerManagement;

/

SET SERVEROUTPUT ON;

CREATE OR REPLACE PACKAGE BODY CUSTOMERMANAGEMENT IS

PROCEDURE ADDNEWCUSTOMER(

P\_CUSTOMER\_ID IN CUSTOMERS.CUSTOMERID%TYPE,

P\_NAME IN CUSTOMERS.NAME%TYPE,

P\_DOB IN CUSTOMERS.DOB%TYPE,

P\_BALANCE IN CUSTOMERS.BALANCE%TYPE

) IS

BEGIN

INSERT INTO CUSTOMERS (CUSTOMERID, NAME, DOB, BALANCE, LASTMODIFIED)

VALUES (P\_CUSTOMER\_ID, P\_NAME, P\_DOB, P\_BALANCE, SYSDATE);

END ADDNEWCUSTOMER;

PROCEDURE UPDATECUSTOMERDETAILS(

P\_CUSTOMER\_ID IN CUSTOMERS.CUSTOMERID%TYPE,

P\_NAME IN CUSTOMERS.NAME%TYPE,

P\_DOB IN CUSTOMERS.DOB%TYPE,

P\_BALANCE IN CUSTOMERS.BALANCE%TYPE

) IS

BEGIN

UPDATE CUSTOMERS

SET NAME = P\_NAME,

DOB = P\_DOB,

BALANCE = P\_BALANCE,

LASTMODIFIED = SYSDATE

WHERE CUSTOMERID = P\_CUSTOMER\_ID;

END UPDATECUSTOMERDETAILS;

FUNCTION GETCUSTOMERBALANCE(

P\_CUSTOMER\_ID IN CUSTOMERS.CUSTOMERID%TYPE

) RETURN CUSTOMERS.BALANCE%TYPE IS

V\_BALANCE CUSTOMERS.BALANCE%TYPE;

BEGIN

SELECT BALANCE INTO V\_BALANCE

FROM CUSTOMERS

WHERE CUSTOMERID = P\_CUSTOMER\_ID;

RETURN V\_BALANCE;

END GETCUSTOMERBALANCE;

END CUSTOMERMANAGEMENT;

/

**OUTPUT:**

A screenshot of a computer program

AI-generated content may be incorrect.

**-- SCENARIO 2**

SET SERVEROUTPUT ON;

CREATE OR REPLACE PACKAGE EMPLOYEEMANAGEMENT IS

PROCEDURE HIREEMPLOYEE(

P\_EMPLOYEE\_ID IN EMPLOYEES.EMPLOYEEID%TYPE,

P\_NAME IN EMPLOYEES.NAME%TYPE,

P\_POSITION IN EMPLOYEES.POSITION%TYPE,

P\_SALARY IN EMPLOYEES.SALARY%TYPE,

P\_DEPARTMENT IN EMPLOYEES.DEPARTMENT%TYPE,

P\_HIRE\_DATE IN EMPLOYEES.HIREDATE%TYPE

);

PROCEDURE UPDATEEMPLOYEEDETAILS(

P\_EMPLOYEE\_ID IN EMPLOYEES.EMPLOYEEID%TYPE,

P\_NAME IN EMPLOYEES.NAME%TYPE,

P\_POSITION IN EMPLOYEES.POSITION%TYPE,

P\_SALARY IN EMPLOYEES.SALARY%TYPE,

P\_DEPARTMENT IN EMPLOYEES.DEPARTMENT%TYPE

);

FUNCTION CALCULATEANNUALSALARY(

P\_EMPLOYEE\_ID IN EMPLOYEES.EMPLOYEEID%TYPE

) RETURN NUMBER;

END EMPLOYEEMANAGEMENT;

/

SET SERVEROUTPUT ON;

CREATE OR REPLACE PACKAGE BODY EMPLOYEEMANAGEMENT IS

PROCEDURE HIREEMPLOYEE(

P\_EMPLOYEE\_ID IN EMPLOYEES.EMPLOYEEID%TYPE,

P\_NAME IN EMPLOYEES.NAME%TYPE,

P\_POSITION IN EMPLOYEES.POSITION%TYPE,

P\_SALARY IN EMPLOYEES.SALARY%TYPE,

P\_DEPARTMENT IN EMPLOYEES.DEPARTMENT%TYPE,

P\_HIRE\_DATE IN EMPLOYEES.HIREDATE%TYPE

) 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 UPDATEEMPLOYEEDETAILS(

P\_EMPLOYEE\_ID IN EMPLOYEES.EMPLOYEEID%TYPE,

P\_NAME IN EMPLOYEES.NAME%TYPE,

P\_POSITION IN EMPLOYEES.POSITION%TYPE,

P\_SALARY IN EMPLOYEES.SALARY%TYPE,

P\_DEPARTMENT IN EMPLOYEES.DEPARTMENT%TYPE

) 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 CALCULATEANNUALSALARY(

P\_EMPLOYEE\_ID IN EMPLOYEES.EMPLOYEEID%TYPE

) RETURN NUMBER IS

V\_SALARY EMPLOYEES.SALARY%TYPE;

BEGIN

SELECT SALARY INTO V\_SALARY

FROM EMPLOYEES

WHERE EMPLOYEEID = P\_EMPLOYEE\_ID;

RETURN V\_SALARY \* 12; -- Assuming salary is monthly

END CALCULATEANNUALSALARY;

END EMPLOYEEMANAGEMENT;

/

**OUTPUT:**

A screenshot of a computer

AI-generated content may be incorrect.

**-- SCENARIO 3**

SET SERVEROUTPUT ON;

CREATE OR REPLACE PACKAGE ACCOUNTOPERATIONS IS

PROCEDURE OPENNEWACCOUNT(

P\_ACCOUNT\_ID IN ACCOUNTS.ACCOUNTID%TYPE,

P\_CUSTOMER\_ID IN ACCOUNTS.CUSTOMERID%TYPE,

P\_ACCOUNT\_TYPE IN ACCOUNTS.ACCOUNTTYPE%TYPE,

P\_BALANCE IN ACCOUNTS.BALANCE%TYPE

);

PROCEDURE CLOSEACCOUNT(

P\_ACCOUNT\_ID IN ACCOUNTS.ACCOUNTID%TYPE

);

FUNCTION GETTOTALBALANCE(

P\_CUSTOMER\_ID IN ACCOUNTS.CUSTOMERID%TYPE

) RETURN NUMBER;

END ACCOUNTOPERATIONS;

/

SET SERVEROUTPUT ON;

CREATE OR REPLACE PACKAGE BODY ACCOUNTOPERATIONS IS

PROCEDURE OPENNEWACCOUNT(

P\_ACCOUNT\_ID IN ACCOUNTS.ACCOUNTID%TYPE,

P\_CUSTOMER\_ID IN ACCOUNTS.CUSTOMERID%TYPE,

P\_ACCOUNT\_TYPE IN ACCOUNTS.ACCOUNTTYPE%TYPE,

P\_BALANCE IN ACCOUNTS.BALANCE%TYPE

) IS

BEGIN

INSERT INTO ACCOUNTS (ACCOUNTID, CUSTOMERID, ACCOUNTTYPE, BALANCE, LASTMODIFIED)

VALUES (P\_ACCOUNT\_ID, P\_CUSTOMER\_ID, P\_ACCOUNT\_TYPE, P\_BALANCE, SYSDATE);

END OPENNEWACCOUNT;

PROCEDURE CLOSEACCOUNT(

P\_ACCOUNT\_ID IN ACCOUNTS.ACCOUNTID%TYPE

) IS

BEGIN

DELETE FROM ACCOUNTS

WHERE ACCOUNTID = P\_ACCOUNT\_ID;

END CLOSEACCOUNT;

FUNCTION GETTOTALBALANCE(

P\_CUSTOMER\_ID IN ACCOUNTS.CUSTOMERID%TYPE

) RETURN NUMBER IS

V\_TOTAL\_BALANCE NUMBER;

BEGIN

SELECT SUM(BALANCE) INTO V\_TOTAL\_BALANCE

FROM ACCOUNTS

WHERE CUSTOMERID = P\_CUSTOMER\_ID;

RETURN V\_TOTAL\_BALANCE;

END GETTOTALBALANCE;

END ACCOUNTOPERATIONS;

/

**OUTPUT:**

A screenshot of a computer program

AI-generated content may be incorrect.