

# **Oracle Database 11g: Develop PL/SQL Program Units**

**Volume III • Student Guide**

D49986GC12

Edition 1.2

April 2009

D59431

**ORACLE®**

**Author**

Lauran K. Serhal

**Technical Contributors  
and Reviewers**

Don Bates  
Claire Bennett  
Zarko Cesljas  
Purjanti Chang  
Ashita Dhir  
Peter Driver  
Gerlinde Frenzen  
Steve Friedberg  
Nancy Greenberg  
Thomas Hoogerwerf  
Akira Kinutani  
Chaitanya Koratamaddi  
Timothy Leblanc  
Bryn Llewellyn  
Lakshmi Narapareddi  
Essi Parast  
Alan Paulson  
Manish Pawar  
Srinivas Putrevu  
Bryan Roberts  
Grant Spencer  
Tulika Srivastava  
Glenn Stokol  
Jenny Tsai-Smith  
Lex Van Der Werff  
Ted Witiuk

**Graphic Designer**

Asha Thamby

**Editors**

Nita Pavitrana  
Aju Kumar

**Publishers**

Sheryl Domingue  
Syed Ali

Copyright © 2009, Oracle. All rights reserved.

**Disclaimer**

This document contains proprietary information and is protected by copyright and other intellectual property laws. You may copy and print this document solely for your own use in an Oracle training course. The document may not be modified or altered in any way. Except where your use constitutes "fair use" under copyright law, you may not use, share, download, upload, copy, print, display, perform, reproduce, publish, license, post, transmit, or distribute this document in whole or in part without the express authorization of Oracle.

The information contained in this document is subject to change without notice. If you find any problems in the document, please report them in writing to: Oracle University, 500 Oracle Parkway, Redwood Shores, California 94065 USA. This document is not warranted to be error-free.

**Restricted Rights Notice**

If this documentation is delivered to the United States Government or anyone using the documentation on behalf of the United States Government, the following notice is applicable:

**U.S. GOVERNMENT RIGHTS**

The U.S. Government's rights to use, modify, reproduce, release, perform, display, or disclose these training materials are restricted by the terms of the applicable Oracle license agreement and/or the applicable U.S. Government contract.

**Trademark Notice**

Oracle is a registered trademark of Oracle Corporation and/or its affiliates. Other names may be trademarks of their respective owners.

# Contents

## Preface

### 1 Introduction

- Lesson Objectives 1-2
- Lesson Agenda 1-3
- Course Objectives 1-4
- Course Agenda 1-5
- The Human Resources (HR) Schema That Is Used in This Course 1-7
- Class Account Information 1-8
- Appendixes Used in This Course 1-9
- PL/SQL Development Environments 1-10
- What Is Oracle SQL Developer? 1-11
- Coding PL/SQL in SQL\*Plus 1-12
- Coding PL/SQL in Oracle JDeveloper 1-13
- Lesson Agenda 1-14
- Starting SQL Developer and Creating a Database Connection 1-15
- Creating Schema Objects 1-16
- Using the SQL Worksheet 1-17
- Executing SQL Statements 1-19
- Saving SQL Scripts 1-20
- Executing Saved Script Files: Method 1 1-21
- Executing Saved SQL Scripts: Method 2 1-22
- Creating an Anonymous Block 1-23
- Editing the PL/SQL Code 1-24
- Lesson Agenda 1-25
- Oracle 11g SQL and PL/SQL Documentation 1-26
- Additional Resources 1-27
- Summary 1-28
- Practice 1 Overview: Getting Started 1-29

### 2 Creating Procedures

- Objectives 2-2
- Lesson Agenda 2-3
- Creating a Modularized Subprogram Design 2-4
- Creating a Layered Subprogram Design 2-5
- Modularizing Development with PL/SQL Blocks 2-6

Anonymous Blocks: Overview	2-7
PL/SQL Execution Environment	2-8
What Are PL/SQL Subprograms?	2-9
The Benefits of Using PL/SQL Subprograms	2-10
Differences Between Anonymous Blocks and Subprograms	2-11
Lesson Agenda	2-12
What Are Procedures?	2-13
Creating Procedures: Overview	2-14
Creating Procedures with the SQL <code>CREATE OR REPLACE</code> Statement	2-15
Creating Procedures Using SQL Developer	2-16
Compiling Procedures and Displaying Compilation Errors in SQL Developer	2-17
Correcting Compilation Errors in SQL Developer	2-18
Naming Conventions of PL/SQL Structures Used in This Course	2-19
What Are Parameters and Parameter Modes?	2-20
Formal and Actual Parameters	2-21
Procedural Parameter Modes	2-22
Comparing the Parameter Modes	2-23
Using the <code>IN</code> Parameter Mode: Example	2-24
Using the <code>OUT</code> Parameter Mode: Example	2-25
Using the <code>IN OUT</code> Parameter Mode: Example	2-26
Viewing the <code>OUT</code> Parameters: Using the <code>DBMS_OUTPUT.PUT_LINE</code> Subroutine	2-27
Viewing <code>OUT</code> Parameters: Using SQL*Plus Host Variables	2-28
Available Notations for Passing Actual Parameters	2-29
Passing Actual Parameters: Creating the <code>add_dept</code> Procedure	2-30
Passing Actual Parameters: Examples	2-31
Using the <code>DEFAULT</code> Option for the Parameters	2-32
Calling Procedures	2-34
Calling Procedures Using SQL Developer	2-35
Lesson Agenda	2-36
Handled Exceptions	2-37
Handled Exceptions: Example	2-38
Exceptions Not Handled	2-39
Exceptions Not Handled: Example	2-40
Removing Procedures: Using the <code>DROP</code> SQL Statement or SQL Developer	2-41
Viewing Procedure Information Using the Data Dictionary Views	2-42
Viewing Procedure Information Using SQL Developer	2-43
Quiz	2-44
Summary	2-45

Practice 2 Overview: Creating,  
Compiling, and Calling Procedures 2-46

### **3 Creating Functions**

Objectives 3-2

Overview of Stored Functions 3-3

Creating Functions 3-4

The Difference Between Procedures and Functions 3-5

Creating and Running Functions: Overview 3-6

Creating and Invoking a Stored Function Using the `CREATE FUNCTION` Statement:

Example 3-7

Using Different Methods for Executing Functions 3-8

Creating and Compiling Functions Using SQL Developer 3-10

Executing Functions Using SQL Developer 3-11

Advantages of User-Defined Functions in SQL Statements 3-12

Using a Function in a SQL Expression: Example 3-13

Calling User-Defined Functions in SQL Statements 3-14

Restrictions When Calling Functions from SQL Expressions 3-15

Controlling Side Effects When Calling Functions from SQL Expressions 3-16

Restrictions on Calling Functions from SQL: Example 3-17

Named and Mixed Notation from SQL 3-18

Named and Mixed Notation from SQL: Example 3-19

Removing Functions: Using the `DROP SQL` Statement or SQL Developer 3-20

Viewing Functions Using Data Dictionary Views 3-21

Quiz 3-22

Summary 3-23

Practice 3: Overview 3-24

### **4 Creating Packages**

Objectives 4-2

Lesson Agenda 4-3

What Are PL/SQL Packages? 4-4

Advantages of Using Packages 4-5

Components of a PL/SQL Package 4-7

The Visibility of a Package's Components 4-8

Developing PL/SQL Packages: Overview 4-9

Lesson Agenda 4-10

Creating the Package Specification: Using the `CREATE PACKAGE` Statement 4-11

Creating the Package Specification: Using SQL Developer 4-12

Creating the Package Body: Using SQL Developer 4-13

Example of a Package Specification: `comm_pkg` 4-14

Creating the Package Body 4-15  
 Example of a Package Body: `comm_pkg` 4-16  
 Invoking the Package Subprograms: Examples 4-17  
 Invoking the Package Subprograms: Using SQL Developer 4-18  
 Creating and Using Bodiless Packages 4-19  
 Removing Packages: Using SQL Developer or the SQL `DROP` Statement 4-20  
 Viewing Packages Using the Data Dictionary 4-21  
 Guidelines for Writing Packages 4-22  
 Quiz 4-23  
 Summary 4-24  
 Practice 4 Overview: Creating and Using Packages 4-25

## 5 Working with Packages

Objectives 5-2  
 Lesson Agenda 5-3  
 Overloading Subprograms in PL/SQL 5-4  
 Overloading Procedures Example: Creating the Package Specification 5-6  
 Overloading Procedures Example: Creating the Package Body 5-7  
 Overloading and the `STANDARD` Package 5-8  
 Illegal Procedure Reference 5-9  
 Using Forward Declarations to Solve Illegal Procedure Reference 5-10  
 Initializing Packages 5-11  
 Using Package Functions in SQL 5-12  
 Controlling Side Effects of PL/SQL Subprograms 5-13  
 Package Function in SQL: Example 5-14  
 Lesson Agenda 5-15  
 Persistent State of Packages 5-16  
 Persistent State of Package Variables: Example 5-18  
 Persistent State of a Package Cursor: Example 5-19  
 Executing the `CURS_PKG` Package 5-21  
 Using PL/SQL Tables of Records in Packages 5-22  
 Quiz 5-23  
 Summary 5-24  
 Practice 5: Overview 5-25

## 6 Using Oracle-Supplied Packages in Application Development

Objectives 6-2  
 Lesson Agenda 6-3  
 Using Oracle-Supplied Packages 6-4  
 Examples of Some Oracle-Supplied Packages 6-5  
 Lesson Agenda 6-6

How the DBMS_OUTPUT Package Works	6-7
Using the UTL_FILE Package to Interact with Operating System Files	6-8
File Processing Using the UTL_FILE Package: Overview	6-9
Using the Available Declared Exceptions in the UTL_FILE Package	6-10
FOPEN and IS_OPEN Functions: Example	6-11
Using UTL_FILE: Example	6-13
What Is the UTL_MAIL Package?	6-15
Setting Up and Using the UTL_MAIL: Overview	6-16
Summary of UTL_MAIL Subprograms	6-17
Installing and Using UTL_MAIL	6-18
The SEND Procedure Syntax	6-19
The SEND_ATTACH_RAW Procedure	6-20
Sending Email with a Binary Attachment: Example	6-21
The SEND_ATTACH_VARCHAR2 Procedure	6-23
Sending Email with a Text Attachment: Example	6-24
Quiz	6-26
Summary	6-27
Practice 6: Overview	6-28

## **7 Using Dynamic SQL**

Objectives	7-2
Lesson Agenda	7-3
Execution Flow of SQL	7-4
Working With Dynamic SQL	7-5
Using Dynamic SQL	7-6
Native Dynamic SQL (NDS)	7-7
Using the EXECUTE IMMEDIATE Statement	7-8
Available Methods for Using NDS	7-9
Dynamic SQL with a DDL Statement: Examples	7-11
Dynamic SQL with DML Statements	7-12
Dynamic SQL with a Single-Row Query: Example	7-13
Dynamic SQL with a Multirow Query: Example	7-14
Declaring Cursor Variables	7-15
Executing a PL/SQL Anonymous Block Dynamically	7-16
Using Native Dynamic SQL to Compile PL/SQL Code	7-17
Lesson Agenda	7-18
Using the DBMS_SQL Package	7-19
Using the DBMS_SQL Package Subprograms	7-20
Using DBMS_SQL with a DML Statement: Deleting Rows	7-22
Using DBMS_SQL with a Parameterized DML Statement	7-23

Dynamic SQL Functional Completeness 7-24  
Quiz 7-25  
Summary 7-26  
Practice 7 Overview: Using Native Dynamic SQL 7-27

## **8 Design Considerations for PL/SQL Code**

Objectives 8-2  
Lesson Agenda 8-3  
Standardizing Constants and Exceptions 8-4  
Standardizing Exceptions 8-5  
Standardizing Exception Handling 8-6  
Standardizing Constants 8-7  
Local Subprograms 8-8  
Definer's Rights Versus Invoker's Rights 8-9  
Specifying Invoker's Rights: Setting `AUTHID` to `CURRENT_USER` 8-10  
Autonomous Transactions 8-11  
Features of Autonomous Transactions 8-12  
Using Autonomous Transactions: Example 8-13  
Lesson Agenda 8-15  
Using the `NOCOPY` Hint 8-16  
Effects of the `NOCOPY` Hint 8-17  
When Does the PL/SQL Compiler Ignore the `NOCOPY` Hint? 8-18  
Using the `PARALLEL_ENABLE` Hint 8-19  
Using the Cross-Session PL/SQL Function Result Cache 8-20  
Enabling Result-Caching for a Function 8-21  
Declaring and Defining a Result-Cached Function: Example 8-22  
Using the `DETERMINISTIC` Clause with Functions 8-24  
Lesson Agenda 8-25  
Bulk Binding 8-26  
Using Bulk Binding: Syntax and Keywords 8-27  
Bulk Binding `FORALL`: Example 8-29  
Using `BULK COLLECT INTO` with Queries 8-31  
Using `BULK COLLECT INTO` with Cursors 8-32  
Using `BULK COLLECT INTO` with a `RETURNING` Clause 8-33  
`FORALL` Support for Sparse Collections 8-34  
Using Bulk Binds in Sparse Collections 8-35  
Using Bulk Bind with Index Array 8-36  
Using the `RETURNING` Clause 8-37  
Quiz 8-38



Summary 8-39  
Practice 8: Overview 8-40

## **9 Creating Triggers**

Objectives 9-2  
What Are Triggers? 9-3  
Defining Triggers 9-4  
Trigger Event Types 9-5  
Application and Database Triggers 9-6  
Business Application Scenarios for Implementing Triggers 9-7  
Available Trigger Types 9-8  
Trigger Event Types and Body 9-9  
Creating DML Triggers Using the `CREATE TRIGGER` Statement 9-10  
Specifying the Trigger Firing (Timing) 9-11  
Statement-Level Triggers Versus Row-Level Triggers 9-12  
Creating DML Triggers Using SQL Developer 9-13  
Trigger-Firing Sequence: Single-Row Manipulation 9-14  
Trigger-Firing Sequence: Multirow Manipulation 9-15  
Creating a DML Statement Trigger Example: `SECURE_EMP` 9-16  
Testing Trigger `SECURE_EMP` 9-17  
Using Conditional Predicates 9-18  
Creating a DML Row Trigger 9-19  
Using `OLD` and `NEW` Qualifiers 9-20  
Using `OLD` and `NEW` Qualifiers: Example 9-21  
Using `OLD` and `NEW` Qualifiers: Example Using `AUDIT_EMP` 9-22  
Using the `WHEN` Clause to Fire a Row Trigger Based on a Condition 9-23  
Summary of the Trigger Execution Model 9-24  
Implementing an Integrity Constraint with an After Trigger 9-25  
`INSTEAD OF` Triggers 9-26  
Creating an `INSTEAD OF` Trigger: Example 9-27  
Creating an `INSTEAD OF` Trigger to Perform DML on Complex Views 9-28  
The Status of a Trigger 9-30  
Creating a Disabled Trigger 9-31  
Managing Triggers Using the `ALTER` and `DROP SQL` Statements 9-32  
Managing Triggers Using SQL Developer 9-33  
Testing Triggers 9-34  
Viewing Trigger Information 9-35  
Using `USER_TRIGGERS` 9-36  
Quiz 9-37

Summary 9-38

Practice 9 Overview: Creating Statement and Row Triggers 9-39

## **10 Creating Compound, DDL, and Event Database Triggers**

Objectives 10-2

What Is a Compound Trigger? 10-3

Working with Compound Triggers 10-4

The Benefits of Using a Compound Trigger 10-5

Timing-Point Sections of a Table Compound Trigger 10-6

Compound Trigger Structure for Tables 10-7

Compound Trigger Structure for Views 10-8

Compound Trigger Restrictions 10-9

Trigger Restrictions on Mutating Tables 10-10

Mutating Table: Example 10-11

Using a Compound Trigger to Resolve the Mutating Table Error 10-13

Using a Compound Trigger to Resolve the Mutating Table Error 10-14

Comparing Database Triggers to Stored Procedures 10-15

Comparing Database Triggers to Oracle Forms Triggers 10-16

Creating Triggers on DDL Statements 10-17

Creating Database-Event Triggers 10-18

Creating Triggers on System Events 10-19

LOGON and LOGOFF Triggers: Example 10-20

CALL Statements in Triggers 10-21

Benefits of Database-Event Triggers 10-22

System Privileges Required to Manage Triggers 10-23

Guidelines for Designing Triggers 10-24

Quiz 10-25

Summary 10-26

Practice 10: Overview 10-27

## **11 Using the PL/SQL Compiler**

Objectives 11-2

Lesson Agenda 11-3

Using the PL/SQL Compiler 11-4

Changes in the PL/SQL Compiler 11-5

Lesson Agenda 11-6

Initialization Parameters for PL/SQL Compilation 11-7

Using the Initialization Parameters for PL/SQL Compilation 11-8

The New Compiler Settings Since Oracle 10g 11-11

Displaying the PL/SQL Initialization Parameters 11-12

Displaying and Setting the PL/SQL Initialization Parameters 11-13

Changing PL/SQL Initialization Parameters: Example	11-14
Lesson Agenda	11-15
Overview of PL/SQL Compile-Time Warnings for Subprograms	11-16
Benefits of Compiler Warnings	11-18
Categories of PL/SQL Compile-Time Warning Messages	11-19
Setting the Warning Messages Levels	11-20
Setting Compiler Warning Levels: Using PLSQL_WARNINGS	11-21
Setting Compiler Warning Levels: Using PLSQL_WARNINGS, Examples	11-22
Setting Compiler Warning Levels: Using PLSQL_WARNINGS in SQL Developer	11-23
Viewing the Current Setting of PLSQL_WARNINGS	11-24
Viewing the Compiler Warnings: Using SQL Developer, SQL*Plus, or Data Dictionary Views	11-25
SQL*Plus Warning Messages: Example	11-26
Guidelines for Using PLSQL_WARNINGS	11-27
Lesson Agenda	11-28
Setting Compiler Warning Levels: Using the DBMS_WARNING Package	11-29
Using the DBMS_WARNING Package Subprograms	11-31
The DBMS_WARNING Procedures: Syntax, Parameters, and Allowed Values	11-32
The DBMS_WARNING Procedures: Example	11-33
The DBMS_WARNING Functions: Syntax, Parameters, and Allowed Values	11-34
The DBMS_WARNING Functions: Example	11-35
Using DBMS_WARNING: Example	11-36
Using the New PLW 06009 Warning Message	11-38
The New PLW 06009 Warning: Example	11-39
Quiz	11-40
Summary	11-41
Practice 11: Overview	11-42

## 12 Managing PL/SQL Code

Objectives	12-2
Lesson Agenda	12-3
What Is Conditional Compilation?	12-4
How Does Conditional Compilation Work?	12-5
Using Selection Directives	12-6
Using Predefined and User-Defined Inquiry Directives	12-7
The PLSQL_CCFLAGS Parameter and the Inquiry Directive	12-8
Displaying the PLSQL_CCFLAGS Initialization Parameter Setting	12-9
The PLSQL_CCFLAGS Parameter and the Inquiry Directive: Example	12-10

Using Conditional Compilation Error Directives to Raise User-Defined Errors	12-11
Using Static Expressions with Conditional Compilation	12-12
The DBMS_DB_VERSION Package: Boolean Constants	12-13
The DBMS_DB_VERSION Package Constants	12-14
Using Conditional Compilation with Database Versions: Example	12-15
Using DBMS_PREPROCESSOR Procedures to Print or Retrieve Source Text	12-17
Lesson Agenda	12-18
What Is Obfuscation?	12-19
Benefits of Obfuscating	12-20
What's New in Dynamic Obfuscating Since Oracle 10g?	12-21
Nonobfuscated PL/SQL Code: Example	12-22
Obfuscated PL/SQL Code: Example	12-23
Dynamic Obfuscation: Example	12-24
The PL/SQL Wrapper Utility	12-25
Running the Wrapper Utility	12-26
Results of Wrapping	12-27
Guidelines for Wrapping	12-28
DBMS_DDL Package Versus the Wrap Utility	12-29
Quiz	12-30
Summary	12-31
Practice 12: Overview	12-32

### 13 Managing Dependencies

Objectives	13-2
Overview of Schema Object Dependencies	13-3
Dependencies	13-4
Direct Local Dependencies	13-5
Querying Direct Object Dependencies: Using the USER_DEPENDENCIES View	13-6
Querying an Object's Status	13-7
Invalidation of Dependent Objects	13-8
Schema Object Change That Invalidates Some Dependents: Example	13-9
Schema Object Change That Invalidates Some Dependents: Example	13-10
Displaying Direct and Indirect Dependencies	13-11
Displaying Dependencies Using the DEPTREE View	13-12
More Precise Dependency Metadata in Oracle Database 11g	13-13
Fine-Grained Dependency Management	13-14
Fine-Grained Dependency Management: Example 1	13-15
Fine-Grained Dependency Management: Example 2	13-17
Impact of Redefining Synonyms Before Oracle Database 10g	13-18

Changes to Synonym Dependencies Starting with Oracle Database 10g	13-19
Maintaining Valid PL/SQL Program Units and Views	13-20
Another Scenario of Local Dependencies	13-21
Guidelines for Reducing Invalidation	13-22
Object Revalidation	13-23
Remote Dependencies	13-24
Concepts of Remote Dependencies	13-25
Setting the REMOTE_DEPENDENCIES_MODE Parameter	13-26
Remote Procedure B Compiles at 8:00 AM	13-27
Local Procedure A Compiles at 9:00 AM	13-28
Execute Procedure A	13-29
Remote Procedure B Recompiled at 11:00 AM	13-30
Execute Procedure A	13-31
Signature Mode	13-32
Recompiling a PL/SQL Program Unit	13-33
Unsuccessful Recompilation	13-34
Successful Recompilation	13-35
Recompiling Procedures	13-36
Packages and Dependencies: Subprogram References the Package	13-37
Packages and Dependencies: Package Subprogram References Procedure	13-38
Quiz	13-39
Summary	13-40
Practice 13 Overview: Managing Dependencies in Your Schema	13-41

## **Appendix A: Practice Solutions**

## **Appendix B: Table Descriptions**

## **Appendix C: Using SQL Developer**

Objectives	C-2
What Is Oracle SQL Developer?	C-3
Specifications of SQL Developer	C-4
Installing SQL Developer	C-5
SQL Developer 1.2 Interface	C-6
Creating a Database Connection	C-7
Browsing Database Objects	C-10
Creating a Schema Object	C-11
Creating a New Table: Example	C-12
Using the SQL Worksheet	C-13
Executing SQL Statements	C-16
Saving SQL Scripts	C-17

Executing Saved Script Files: Method 1	C-18
Executing Saved Script Files: Method 2	C-19
Executing SQL Statements	C-20
Formatting the SQL Code	C-21
Using Snippets	C-22
Using Snippets: Example	C-23
Using SQL*Plus	C-24
Debugging Procedures and Functions	C-25
Database Reporting	C-26
Creating a User-Defined Report	C-27
Search Engines and External Tools	C-28
Setting Preferences	C-29
Specifications of SQL Developer 1.5.3	C-30
Installing SQL Developer 1.5.3	C-31
SQL Developer 1.5.3 Interface	C-32
Summary	C-34

## **Appendix D: Review of PL/SQL**

Block Structure for Anonymous PL/SQL Blocks	D-2
Declaring PL/SQL Variables	D-3
Declaring Variables with the %TYPE Attribute: Examples	D-4
Creating a PL/SQL Record	D-5
%ROWTYPE Attribute: Examples	D-6
Creating a PL/SQL Table	D-7
SELECT Statements in PL/SQL: Example	D-8
Inserting Data: Example	D-9
Updating Data: Example	D-10
Deleting Data: Example	D-11
COMMIT and ROLLBACK Statements	D-12
SQL Cursor Attributes	D-13
IF, THEN, and ELSIF Statements: Example	D-14
Basic Loop: Example	D-15
FOR Loop: Example	D-16
WHILE Loop: Example	D-17
Controlling Explicit Cursors	D-18
Declaring the Cursor: Example	D-19
Opening the Cursor	D-20
Fetching Data from the Cursor: Examples	D-21
Closing the Cursor	D-22
Explicit Cursor Attributes	D-23

Cursor FOR Loops: Example D-24  
 FOR UPDATE Clause: Example D-25  
 WHERE CURRENT OF Clause: Example D-26  
 Trapping Predefined Oracle Server Errors D-27  
 Trapping Predefined Oracle Server Errors: Example D-28  
 Non-Predefined Error D-29  
 User-Defined Exceptions: Example D-30  
 RAISE\_APPLICATION\_ERROR Procedure D-31

## **Appendix E: Using SQL\*Plus**

Objectives E-2  
 SQL and SQL\*Plus Interaction E-3  
 SQL Statements Versus SQL\*Plus Commands E-4  
 Overview of SQL\*Plus E-5  
 Logging In to SQL\*Plus: Available Methods E-6  
 Customizing the SQL\*Plus Environment E-7  
 Displaying Table Structure E-8  
 SQL\*Plus Editing Commands E-10  
 Using LIST, n, and APPEND E-12  
 Using the CHANGE Command E-13  
 SQL\*Plus File Commands E-14  
 Using the SAVE, START, and EDIT Commands E-15  
 SQL\*Plus Enhancements Since Oracle Database 10g E-17  
 Changes to the SERVEROUTPUT Command E-18  
 White Space Support in File and Path Names in Windows E-19  
 Predefined SQL\*Plus Variables E-20  
 Using the New Predefined SQL\*Plus Variables: Examples E-21  
 The SHOW Command and the New RECYCLEBIN Clause E-22  
 The SHOW Command and the RECYCLEBIN Clause: Example E-23  
 Using the SQL\*Plus SPOOL Command E-24  
 Using the SQL\*Plus SPOOL Command: Examples E-25  
 The COPY Command: New Error Messages E-26  
 Change in the DESCRIBE Command Behavior E-29  
 The SET PAGESIZE Command E-30  
 The SQLPLUS Program and the Compatibility Option E-31  
 Using the AUTOTRACE Command E-32  
 Displaying a Plan Table Using the DBMS\_XPLAN.DISPLAY Package  
 Function E-33  
 Summary E-34

**Appendix F: Studies for Implementing Triggers**

- Objectives F-2
- Controlling Security Within the Server F-3
- Controlling Security with a Database Trigger F-4
- Enforcing Data Integrity Within the Server F-5
- Protecting Data Integrity with a Trigger F-6
- Enforcing Referential Integrity Within the Server F-7
- Protecting Referential Integrity with a Trigger F-8
- Replicating a Table Within the Server F-9
- Replicating a Table with a Trigger F-10
- Computing Derived Data Within the Server F-11
- Computing Derived Values with a Trigger F-12
- Logging Events with a Trigger F-13
- Summary F-15

**Appendix G: Using the DBMS\_SCHEDULER and HTP Packages**

- Objectives G-2
- Generating Web Pages with the HTP Package G-3
- Using the HTP Package Procedures G-4
- Creating an HTML File with SQL\*Plus G-5
- The DBMS\_SCHEDULER Package G-6
- Creating a Job G-8
- Creating a Job with Inline Parameters G-9
- Creating a Job Using a Program G-10
- Creating a Job for a Program with Arguments G-11
- Creating a Job Using a Schedule G-12
- Setting the Repeat Interval for a Job G-13
- Creating a Job Using a Named Program and Schedule G-14
- Managing Jobs G-15
- Data Dictionary Views G-16
- Summary G-17

**Appendix H: Review of JDeveloper**

- JDeveloper H-2
- Connection Navigator H-3
- Application Navigator H-4
- Structure Window H-5
- Editor Window H-6
- Deploying Java Stored Procedures H-7
- Publishing Java to PL/SQL H-8
- Creating Program Units H-9



Compiling H-10  
Running a Program Unit H-11  
Dropping a Program Unit H-12  
Debugging PL/SQL Programs H-13  
Setting Breakpoints H-16  
Stepping Through Code H-17  
Examining and Modifying Variables H-18

## **Index**

## **Additional Practices**

### **Additional Practice: Solutions**

### **Additional Practices: Table Descriptions and Data**



---

# Additional Practices

---

Oracle University and ORACLE CORPORATION use only

## Additional Practices: Overview

These additional practices are provided as a supplement to the course *Oracle Database 11g: Develop PL/SQL Program Units*. In these practices, you apply the concepts that you learned in the course.

The additional practices comprise two parts:

Part A provides supplemental exercises to create stored procedures, functions, packages, and triggers, and to use the Oracle-supplied packages with SQL Developer or SQL\*Plus as the development environment. The tables used in this portion of the additional practice include EMPLOYEES, JOBS, JOB\_HISTORY, and DEPARTMENTS.

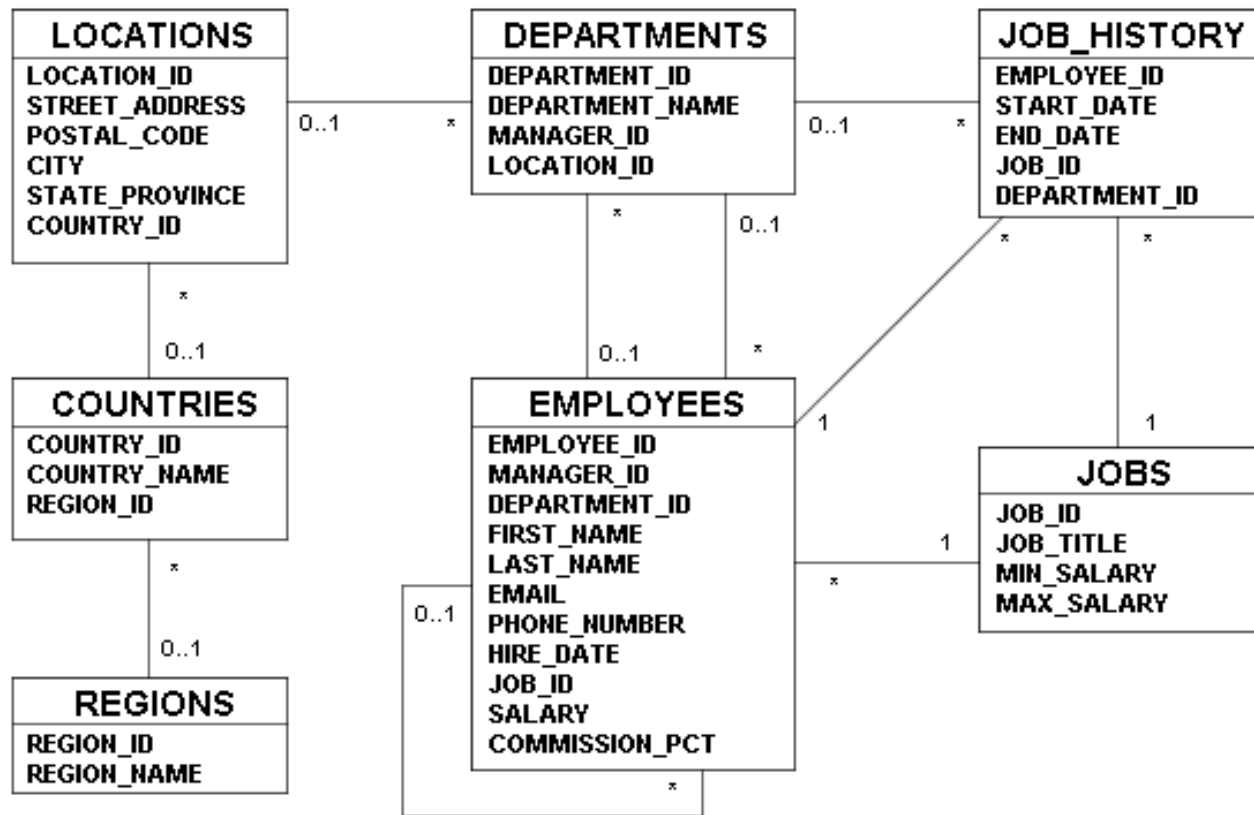
Part B is a case study that can be completed at the end of the course. This part supplements the practices for creating and managing program units. The tables used in the case study are based on a video database and contain the TITLE, TITLE\_COPY, RENTAL, RESERVATION, and MEMBER tables.

An entity relationship diagram is provided at the start of part A and part B. Each entity relationship diagram displays the table entities and their relationships. More detailed definitions of the tables and the data contained in them is provided in the appendix titled “Additional Practices: Table Descriptions and Data.”

## Part A

### Entity Relationship Diagram

#### Human Resources:



## Part A (continued)

**Note:** These exercises can be used for extra practice when discussing how to create procedures.

1. In this exercise, create a program to add a new job into the JOBS table.
  - a. Create a stored procedure called NEW\_JOB to enter a new order into the JOBS table. The procedure should accept three parameters. The first and second parameters supply a job ID and a job title. The third parameter supplies the minimum salary. Use the maximum salary for the new job as twice the minimum salary supplied for the job ID.
  - b. Invoke the procedure to add a new job with job ID 'SY\_ANAL', job title 'System Analyst', and minimum salary of 6000.
  - c. Check whether a row was added and note the new job ID for use in the next exercise. Commit the changes.
2. In this exercise, create a program to add a new row to the JOB\_HISTORY table, for an existing employee.
  - a. Create a stored procedure called ADD\_JOB\_HIST to add a new row into the JOB\_HISTORY table for an employee who is changing his job to the new job ID ('SY\_ANAL') that you created in exercise 1 b.  
 The procedure should provide two parameters, one for the employee ID who is changing the job, and the second for the new job ID. Read the employee ID from the EMPLOYEES table and insert it into the JOB\_HISTORY table. Make the hire date of this employee as start date and today's date as end date for this row in the JOB\_HISTORY table.  
 Change the hire date of this employee in the EMPLOYEES table to today's date.  
 Update the job ID of this employee to the job ID passed as parameter (use the 'SY\_ANAL' job ID) and salary equal to the minimum salary for that job ID + 500.  
**Note:** Include exception handling to handle an attempt to insert a nonexistent employee.
  - b. Disable all triggers on the EMPLOYEES, JOBS, and JOB\_HISTORY tables before invoking the ADD\_JOB\_HIST procedure.
  - c. Execute the procedure with employee ID 106 and job ID 'SY\_ANAL' as parameters.
  - d. Query the JOB\_HISTORY and EMPLOYEES tables to view your changes for employee 106, and then commit the changes.
  - e. Reenable the triggers on the EMPLOYEES, JOBS, and JOB\_HISTORY tables.
3. In this exercise, create a program to update the minimum and maximum salaries for a job in the JOBS table.
  - a. Create a stored procedure called UPD\_JOBSAL to update the minimum and maximum salaries for a specific job ID in the JOBS table. The procedure should provide three parameters: the job ID, a new minimum salary, and a new maximum salary. Add exception handling to account for an invalid job ID in the JOBS table. Raise an exception if the maximum salary supplied is less than the minimum salary, and provide a message that will be displayed if the row in the JOBS table is locked.  
**Hint:** The resource locked/busy error number is -54.

**Part A (continued)**

- b. Execute the UPD\_JOBSAL procedure by using a job ID of 'SY\_ANAL', a minimum salary of 7000 and a maximum salary of 140.
  - Note:** This should generate an exception message.
  - c. Disable triggers on the EMPLOYEES and JOBS tables.
  - d. Execute the UPD\_JOBSAL procedure using a job ID of 'SY\_ANAL', a minimum salary of 7000, and a maximum salary of 14000.
  - e. Query the JOBS table to view your changes, and then commit the changes.
  - f. Enable the triggers on the EMPLOYEES and JOBS tables.
4. In this exercise, create a procedure to monitor whether employees have exceeded their average salaries for their job type.
- a. Disable the SECURE\_EMPLOYEES trigger.
  - b. In the EMPLOYEES table, add an EXCEED\_AVGSAL column to store up to three characters and a default value of NO. Use a check constraint to allow the values YES or NO.
  - c. Write a stored procedure called CHECK\_AVGSAL that checks whether each employee's salary exceeds the average salary for the JOB\_ID. The average salary for a job is calculated from the information in the JOBS table. If the employee's salary exceeds the average for his or her job, then update the EXCEED\_AVGSAL column in the EMPLOYEES table to a value of YES; otherwise, set the value to NO. Use a cursor to select the employee's rows using the FOR UPDATE option in the query. Add exception handling to account for a record being locked.
  - Hint:** The resource locked/busy error number is -54. Write and use a local function called GET\_JOB\_AVGSAL to determine the average salary for a job ID specified as a parameter.
  - d. Execute the CHECK\_AVGSAL procedure. Then, to view the results of your modifications, write a query to display the employee's ID, job, the average salary for the job, the employee's salary and the exceed\_avgsal indicator column for employees whose salaries exceed the average for their job, and finally commit the changes.

**Note:** These exercises can be used for extra practice when discussing how to create functions.

5. Create a subprogram to retrieve the number of years of service for a specific employee.
- a. Create a stored function called GET\_YEARS\_SERVICE to retrieve the total number of years of service for a specific employee. The function should accept the employee ID as a parameter and return the number of years of service. Add error handling to account for an invalid employee ID.
  - b. Invoke the GET\_YEARS\_SERVICE function in a call to DBMS\_OUTPUT.PUT\_LINE for an employee with ID 999.
  - c. Display the number of years of service for employee 106 with DBMS\_OUTPUT.PUT\_LINE invoking the GET\_YEARS\_SERVICE function.
  - d. Query the JOB\_HISTORY and EMPLOYEES tables for the specified employee to verify that the modifications are accurate. The values represented in the results on this page may differ from those you get when you run these queries.

## Part A (continued)

6. In this exercise, create a program to retrieve the number of different jobs that an employee worked on during his or her service.

- a. Create a stored function called `GET_JOB_COUNT` to retrieve the total number of different jobs on which an employee worked.

The function should accept the employee ID in a parameter, and return the number of different jobs that the employee worked on until now, including the present job. Add exception handling to account for an invalid employee ID.

**Hint:** Use the distinct job IDs from the `JOB_HISTORY` table, and exclude the current job ID, if it is one of the job IDs on which the employee has already worked. Write a `UNION` of two queries and count the rows retrieved into a PL/SQL table. Use a `FETCH` with `BULK COLLECT INTO` to obtain the unique jobs for the employee.

- b. Invoke the function for the employee with the ID of 176.

**Note:** These exercises can be used for extra practice when discussing how to create packages.

7. Create a package called `EMPJOB_PKG` that contains your `NEW_JOB`, `ADD_JOB_HIST`, `UPD_JOBSAL` procedures, as well as your `GET_YEARS_SERVICE` and `GET_JOB_COUNT` functions.

- a. Create the package specification with all the subprogram constructs as public. Move any subprogram local-defined types into the package specification.
  - b. Create the package body with the subprogram implementation; remember to remove, from the subprogram implementations, any types that you moved into the package specification.
  - c. Invoke your `EMPJOB_PKG.NEW_JOB` procedure to create a new job with the ID `PR_MAN`, the job title `Public Relations Manager`, and the salary `6250`.
  - d. Invoke your `EMPJOB_PKG.ADD_JOB_HIST` procedure to modify the job of employee ID `110` to job ID `PR_MAN`.

**Note:** You need to disable the `UPDATE_JOB_HISTORY` trigger before you execute the `ADD_JOB_HIST` procedure, and re-enable the trigger after you have executed the procedure.

- e. Query the `JOBS`, `JOB_HISTORY`, and `EMPLOYEES` tables to verify the results.

**Note:** These exercises can be used for extra practice when discussing how to create database triggers.

8. In this exercise, create a trigger to ensure that the minimum and maximum salaries of a job are never modified such that the salary of an existing employee with that job ID is out of the new range specified for the job.
- a. Create a trigger called `CHECK_SAL_RANGE` that is fired before every row that is updated in the `MIN_SALARY` and `MAX_SALARY` columns in the `JOBS` table. For any minimum or maximum salary value that is changed, check whether the salary of any existing employee with that job ID in the `EMPLOYEES` table falls within the new range of salaries specified for this job ID. Include exception handling to cover a salary range change that affects the record of any existing employee.

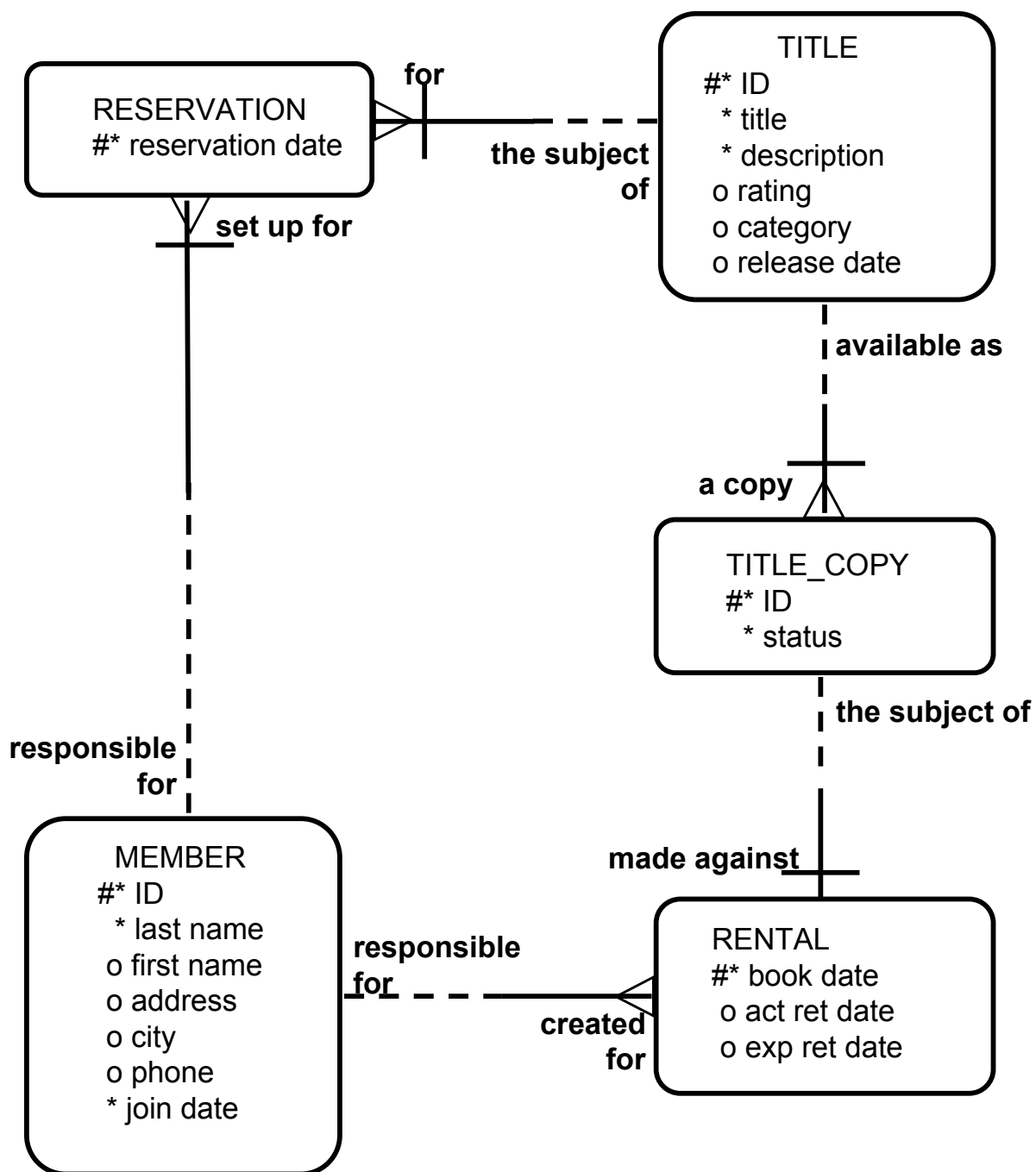


## Part A (continued)

- b. Test the trigger using the SY\_ANAL job, setting the new minimum salary to 5000, and the new maximum salary to 7000. Before you make the change, write a query to display the current salary range for the SY\_ANAL job ID, and another query to display the employee ID, last name, and salary for the same job ID. After the update, query the change (if any) to the JOBS table for the specified job ID.
- c. Using the SY\_ANAL job, set the new minimum salary to 7,000, and the new maximum salary to 18000. Explain the results.

## Part B

### Entity Relationship Diagram



## Part B (continued)

In this case study, you create a package named VIDEO\_PKG that contains procedures and functions for a video store application. This application enables customers to become a member of the video store. Any member can rent movies, return rented movies, and reserve movies. Additionally, you create a trigger to ensure that any data in the video tables is modified only during business hours.

Create the package by using SQL\*Plus and use the DBMS\_OUTPUT Oracle-supplied package to display messages.

The video store database contains the following tables: TITLE, TITLE\_COPY, RENTAL, RESERVATION, and MEMBER. The entity relationship diagram is shown on the previous page.

**Part B (continued)**

1. Load and execute the D:\labs\PLPU\labs\buildvid1.sql script to create all the required tables and sequences that are needed for this exercise.
2. Load and execute the D:\labs\PLPU\labs\buildvid2.sql script to populate all the tables created through the buildvid1.sql script.
3. Create a package named VIDEO\_PKG with the following procedures and functions:
  - a. **NEW\_MEMBER:** A public procedure that adds a new member to the MEMBER table. For the member ID number, use the sequence MEMBER\_ID\_SEQ; for the join date, use SYSDATE. Pass all other values to be inserted into a new row as parameters.
  - b. **NEW\_RENTAL:** An overloaded public function to record a new rental. Pass the title ID number for the video that a customer wants to rent, and either the customer's last name or his member ID number into the function. The function should return the due date for the video. Due dates are three days from the date the video is rented. If the status for a movie requested is listed as AVAILABLE in the TITLE\_COPY table for one copy of this title, then update this TITLE\_COPY table and set the status to RENTED. If there is no copy available, the function must return NULL. Then, insert a new record into the RENTAL table identifying the booked date as today's date, the copy ID number, the member ID number, the title ID number, and the expected return date. Be aware of multiple customers with the same last name. In this case, have the function return NULL, and display a list of the customers' names that match and their ID numbers.
  - c. **RETURN\_MOVIE:** A public procedure that updates the status of a video (available, rented, or damaged) and sets the return date. Pass the title ID, the copy ID, and the status to this procedure. Check whether there are reservations for that title and display a message if it is reserved. Update the RENTAL table and set the actual return date to today's date. Update the status in the TITLE\_COPY table based on the status parameter passed into the procedure.
  - d. **RESERVE\_MOVIE:** A private procedure that executes only if all the video copies requested in the NEW\_RENTAL procedure have a status of RENTED. Pass the member ID number and the title ID number to this procedure. Insert a new record into the RESERVATION table and record the reservation date, member ID number, and title ID number. Print a message indicating that a movie is reserved and its expected date of return.
  - e. **EXCEPTION\_HANDLER:** A private procedure that is called from the exception handler of the public programs. Pass the SQLCODE number to this procedure, and the name of the program (as a text string) where the error occurred. Use RAISE\_APPLICATION\_ERROR to raise a customized error. Start with a unique key violation (-1) and foreign key violation (-2292). Allow the exception handler to raise a generic error for any other errors.

## Part B (continued)

4. Use the following scripts located in the E:\labs\PLPU\soln directory to test your routines:
  - a. Add two members using `sol_apb_04_a_new_members.sql`.
  - b. Add new video rentals using `sol_apb_04_b_new_rentals.sql`.
  - c. Return movies using the `sol_apb_04_c_return_movie.sql` script.
5. The business hours for the video store are 8:00 AM through 10:00 PM, Sunday through Friday, and 8:00 AM through 12:00 PM on Saturday. To ensure that the tables can be modified only during these hours, create a stored procedure that is called by triggers on the tables.
  - a. Create a stored procedure called `TIME_CHECK` that checks the current time against business hours. If the current time is not within business hours, use the `RAISE_APPLICATION_ERROR` procedure to give an appropriate message.
  - b. Create a trigger on each of the five tables. Fire the trigger before data is inserted, updated, and deleted from the tables. Call your `TIME_CHECK` procedure from each of these triggers.



---

# **Additional Practice: Solutions**

---

Oracle University and ORACLE CORPORATION use only

## Part A: Additional Practice 1 Solutions

1. In this exercise, create a program to add a new job into the JOBS table.
  - a. Create a stored procedure called NEW\_JOB to enter a new order into the JOBS table. The procedure should accept three parameters. The first and second parameters supply a job ID and a job title. The third parameter supplies the minimum salary. Use the maximum salary for the new job as twice the minimum salary supplied for the job ID.

```
CREATE OR REPLACE PROCEDURE new_job(  
  p_jobid  IN jobs.job_id%TYPE,  
  p_title  IN jobs.job_title%TYPE,  
  v_minsal IN jobs.min_salary%TYPE) IS  
  v_maxsal jobs.max_salary%TYPE := 2 * v_minsal;  
BEGIN  
  INSERT INTO jobs(job_id, job_title, min_salary, max_salary)  
  VALUES (p_jobid, p_title, v_minsal, v_maxsal);  
  DBMS_OUTPUT.PUT_LINE ('New row added to JOBS table:');  
  DBMS_OUTPUT.PUT_LINE (p_jobid || ' ' || p_title || ' ' ||  
                        v_minsal || ' ' || v_maxsal);  
END new_job;  
/  
SHOW ERRORS  
  
PROCEDURE new_job Compiled.  
No Errors.
```

- b. Invoke the procedure to add a new job with job ID 'SY\_ANAL', job title 'System Analyst', and minimum salary 6,000.

```
EXECUTE new_job ('SY_ANAL', 'System Analyst', 6000)  
  
anonymous block completed  
New row added to JOBS table:  
SY_ANAL System Analyst 6000 12000
```

- c. Verify that a row was added, and note the new job ID for use in the next exercise. Commit the changes.

```
SELECT *  
FROM   jobs  
WHERE  job_id = 'SY_ANAL';
```

JOB_ID	JOB_TITLE	MIN_SALARY	MAX_SALARY
SY_ANAL	System Analyst	6000	12000

```
COMMIT;  
  
Commit complete.
```



## Part A: Additional Practice 2 Solutions

2. In this exercise, create a program to add a new row to the JOB\_HISTORY table for an existing employee.
  - a. Create a stored procedure called ADD\_JOB\_HIST to add a new row into the JOB\_HISTORY table for an employee who is changing his job to the new job ID ('SY\_ANAL') that you created in exercise 1b.

The procedure should provide two parameters: one for the employee ID who is changing the job, and the second for the new job ID. Read the employee ID from the EMPLOYEES table and insert it into the JOB\_HISTORY table. Make the hire date of this employee as the start date and today's date as the end date for this row in the JOB\_HISTORY table.

Change the hire date of this employee in the EMPLOYEES table to today's date. Update the job ID of this employee to the job ID passed as parameter (use the 'SY\_ANAL' job ID) and salary equal to the minimum salary for that job ID plus 500.

**Note:** Include exception handling to handle an attempt to insert a nonexistent employee.

```
CREATE OR REPLACE PROCEDURE add_job_hist(
  p_emp_id      IN employees.employee_id%TYPE,
  p_new_jobid IN jobs.job_id%TYPE) IS
BEGIN
  INSERT INTO job_history
    SELECT employee_id, hire_date, SYSDATE, job_id, department_id
    FROM   employees
    WHERE  employee_id = p_emp_id;
  UPDATE employees
    SET   hire_date = SYSDATE,
          job_id = p_new_jobid,
          salary = (SELECT min_salary + 500
                    FROM   jobs
                    WHERE  job_id = p_new_jobid)
    WHERE employee_id = p_emp_id;
  DBMS_OUTPUT.PUT_LINE ('Added employee ' || p_emp_id ||
    ' details to the JOB_HISTORY table');
  DBMS_OUTPUT.PUT_LINE ('Updated current job of employee ' ||
    p_emp_id || ' to ' || p_new_jobid);
EXCEPTION
  WHEN NO_DATA_FOUND THEN
    RAISE_APPLICATION_ERROR (-20001, 'Employee does not exist!');
END add_job_hist;
/
SHOW ERRORS

PROCEDURE add_job_hist( Compiled.
No Errors.
```

**Part A: Additional Practice 2 Solutions (continued)**

- b. Disable all triggers on the EMPLOYEES, JOBS, and JOB\_HISTORY tables before invoking the ADD\_JOB\_HIST procedure.

```
ALTER TABLE employees DISABLE ALL TRIGGERS;
ALTER TABLE jobs DISABLE ALL TRIGGERS;
ALTER TABLE job_history DISABLE ALL TRIGGERS;

ALTER TABLE employees succeeded.
ALTER TABLE jobs succeeded.
ALTER TABLE job_history succeeded.
```

- c. Execute the procedure with employee ID 106 and job ID 'SY\_ANAL' as parameters.

```
EXECUTE add_job_hist(106, 'SY_ANAL')

anonymous block completed
Added employee 106 details to the JOB_HISTORY table
Updated current job of employee 106 to SY_ANAL
```

- d. Query the JOB\_HISTORY and EMPLOYEES tables to view your changes for employee 106, and then commit the changes.

```
SELECT * FROM job_history
WHERE employee_id = 106;

SELECT job_id, salary FROM employees
WHERE employee_id = 106;

COMMIT;
```

EMPLOYEE_ID	START_DATE	END_DATE	JOB_ID	DEPARTMENT_ID
106	05-FEB-98	07-JUN-07	IT_PROG	60

JOB_ID	SALARY
SY_ANAL	6500

Commit complete.

- e. Reenable the triggers on the EMPLOYEES, JOBS, and JOB\_HISTORY tables.

```
ALTER TABLE employees ENABLE ALL TRIGGERS;
ALTER TABLE jobs ENABLE ALL TRIGGERS;
ALTER TABLE job_history ENABLE ALL TRIGGERS;

ALTER TABLE employees succeeded.
ALTER TABLE jobs succeeded.
ALTER TABLE job_history succeeded.
```

## Part A: Additional Practice 3 Solutions

3. In this exercise, create a program to update the minimum and maximum salaries for a job in the JOBS table.
  - a. Create a stored procedure called UPD\_JOBSAL to update the minimum and maximum salaries for a specific job ID in the JOBS table. The procedure should provide three parameters: the job ID, a new minimum salary, and a new maximum salary. Add exception handling to account for an invalid job ID in the JOBS table. Raise an exception if the maximum salary supplied is less than the minimum salary. Provide a message that will be displayed if the row in the JOBS table is locked.

**Hint:** The resource locked/busy error number is -54.

```
CREATE OR REPLACE PROCEDURE upd_jobsal (
  p_jobid          IN jobs.job_id%type,
  p_new_minsal     IN jobs.min_salary%type,
  p_new_maxsal     IN jobs.max_salary%type) IS
  v_dummy          PLS_INTEGER;
  e_resource_busy  EXCEPTION;
  e_sal_error      EXCEPTION;
  PRAGMA          EXCEPTION_INIT (e_resource_busy , -54);
BEGIN
  IF (p_new_maxsal < p_new_minsal) THEN
    RAISE e_sal_error;
  END IF;
  SELECT 1 INTO v_dummy
    FROM jobs
   WHERE job_id = p_jobid
  FOR UPDATE OF min_salary NOWAIT;
  UPDATE jobs
    SET min_salary = p_new_minsal,
        max_salary = p_new_maxsal
   WHERE job_id = p_jobid;
EXCEPTION
  WHEN e_resource_busy THEN
    RAISE_APPLICATION_ERROR (-20001,
      'Job information is currently locked, try later.');
```

```
  WHEN NO_DATA_FOUND THEN
    RAISE_APPLICATION_ERROR(-20001, 'This job ID does not exist');
```

```
  WHEN e_sal_error THEN
    RAISE_APPLICATION_ERROR(-20001,
      'Data error: Max salary should be more than min salary');
```

```
END upd_jobsal;
/
SHOW ERRORS

PROCEDURE upd_jobsal( Compiled.
No Errors.
```

**Part A: Additional Practice 3 Solutions (continued)**

- b. Execute the UPD\_JOBSAL procedure by using a job ID of 'SY\_ANAL', a minimum salary of 7000, and a maximum salary of 140.

**Note:** This should generate an exception message.

```
EXECUTE upd_jobsal('SY_ANAL', 7000, 140)

BEGIN upd_jobsal('SY_ANAL', 7000, 140); END;

*

ERROR at line 1:
ORA-20001: Data error: Max salary should be more than min salary
ORA-06512: at "ORA1.UPD_JOBSAL", line 28
ORA-06512: at line 1
```

- c. Disable triggers on the EMPLOYEES and JOBS tables.

```
ALTER TABLE employees DISABLE ALL TRIGGERS;
ALTER TABLE jobs DISABLE ALL TRIGGERS;

ALTER TABLE employees succeeded.
ALTER TABLE jobs succeeded.
```

- d. Execute the UPD\_JOBSAL procedure using a job ID of 'SY\_ANAL', a minimum salary of 7000, and a maximum salary of 14000.

```
EXECUTE upd_jobsal('SY_ANAL', 7000, 14000)

anonymous block completed.
```

- e. Query the JOBS table to view your changes, and then commit the changes.

```
SELECT *
FROM jobs
WHERE job_id = 'SY_ANAL';
```

JOB_ID	JOB_TITLE	MIN_SALARY	MAX_SALARY
SY_ANAL	System Analyst	7000	14000

- f. Enable the triggers on the EMPLOYEES and JOBS tables.

```
ALTER TABLE employees ENABLE ALL TRIGGERS;
ALTER TABLE jobs ENABLE ALL TRIGGERS;

ALTER TABLE employees succeeded.
ALTER TABLE jobs succeeded.
```

## Part A: Additional Practice 4 Solutions

4. In this exercise, create a procedure to monitor whether employees have exceeded their average salaries for their job type.

- a. Disable the SECURE\_EMPLOYEES trigger.

```
ALTER TRIGGER secure_employees DISABLE;  
  
ALTER TRIGGER secure_employees succeeded.
```

- b. In the EMPLOYEES table, add an EXCEED\_AVGSAL column for storing up to three characters and a default value of NO. Use a check constraint to allow the values YES or NO.

```
ALTER TABLE employees (  
  ADD (exceed_avgsal VARCHAR2(3) DEFAULT 'NO'  
    CONSTRAINT employees_exceed_avgsal_ck  
    CHECK (exceed_avgsal IN ('YES', 'NO')));  
  
ALTER TABLE employees succeeded.
```

- c. Write a stored procedure called CHECK\_AVGSAL that checks whether each employee's salary exceeds the average salary for the JOB\_ID. The average salary for a job is calculated from information in the JOBS table. If the employee's salary exceeds the average for his or her job, then update his or her EXCEED\_AVGSAL column in the EMPLOYEES table to a value of YES; otherwise, set the value to NO. Use a cursor to select the employee's rows using the FOR UPDATE option in the query. Add exception handling to account for a record being locked.

**Hint:** The resource locked/busy error number is -54. Write and use a local function called GET\_JOB\_AVGSAL to determine the average salary for a job ID specified as a parameter.

```
CREATE OR REPLACE PROCEDURE check_avgsal IS  
  emp_exceed_avgsal_type employees.exceed_avgsal%type;  
  CURSOR c_emp_csr IS  
    SELECT employee_id, job_id, salary  
    FROM employees  
    FOR UPDATE;  
  e_resource_busy EXCEPTION;  
  PRAGMA EXCEPTION_INIT(e_resource_busy, -54);  
  FUNCTION get_job_avgsal (jobid VARCHAR2) RETURN NUMBER IS  
    avg_sal employees.salary%type;  
  BEGIN  
    SELECT (max_salary + min_salary)/2 INTO avg_sal  
    FROM jobs  
    WHERE job_id = jobid;  
    RETURN avg_sal;  
  END;  
  
BEGIN  
  FOR emprec IN c_emp_csr
```

```

LOOP
  emp_exceed_avg_sal_type := 'NO';
  IF emp_rec.salary >= get_job_avg_sal(emp_rec.job_id) THEN
    emp_exceed_avg_sal_type := 'YES';
  END IF;
  UPDATE employees
    SET exceed_avg_sal = emp_exceed_avg_sal_type
    WHERE CURRENT OF c_emp_csr;
END LOOP;
EXCEPTION
  WHEN e_resource_busy THEN
    ROLLBACK;
    RAISE_APPLICATION_ERROR (-20001, 'Record is busy, try later.');
```

END check\_avg\_sal;

/

SHOW ERRORS

PROCEDURE check\_avg\_sal Compiled.

No Errors.

- d. Execute the CHECK\_AVG\_SAL procedure. Then, to view the results of your modifications, write a query to display the employee's ID, job, the average salary for the job, the employee's salary, and the exceed\_avg\_sal indicator column for employees whose salaries exceed the average for their job, and finally commit the changes.

```

EXECUTE check_avg_sal

SELECT e.employee_id, e.job_id, (j.max_salary-j.min_salary/2) job_avg_sal,
       e.salary, e.exceed_avg_sal avg_exceeded
FROM   employees e, jobs j
WHERE  e.job_id = j.job_id
and e.exceed_avg_sal = 'YES';

COMMIT;
```

## Part A: Additional Practice 4 Solutions (continued)

anonymous block completed.

EMPLOYEE_ID	JOB_ID	JOB_AVGSAL	SALARY	AVG_EXCEEDED
103	IT_PROG	8000	9000	YES
109	FI_ACCOUNT	6900	9000	YES
110	FI_ACCOUNT	6900	8200	YES
111	FI_ACCOUNT	6900	7700	YES
112	FI_ACCOUNT	6900	7800	YES
113	FI_ACCOUNT	6900	6900	YES
120	ST_MAN	5750	8000	YES
121	ST_MAN	5750	8200	YES

. . .

25	185 SH_CLERK	4250	4100	YES
26	192 SH_CLERK	4250	4000	YES
27	201 MK_MAN	10500	13000	YES
28	203 HR_REP	7000	6500	YES
29	204 PR_REP	8250	10000	YES
30	206 AC_ACCOUNT	6900	8300	YES

Commit complete.

## Part A: Additional Practice 5 Solutions

5. Create a subprogram to retrieve the number of years of service for a specific employee.
  - a. Create a stored function called GET\_YEARS\_SERVICE to retrieve the total number of years of service for a specific employee. The function should accept the employee ID as a parameter and return the number of years of service. Add error handling to account for an invalid employee ID.

```
CREATE OR REPLACE FUNCTION get_years_service(  
  p_emp_empid_type IN employees.employee_id%TYPE) RETURN NUMBER IS  
  CURSOR c_jobh_csr IS  
    SELECT MONTHS_BETWEEN(end_date, start_date)/12 v_years_in_job  
    FROM    job_history  
    WHERE   employee_id = p_emp_empid_type;  
  v_years_service NUMBER(2) := 0;  
  v_years_in_job   NUMBER(2) := 0;  
BEGIN  
  FOR jobh_rec IN c_jobh_csr  
  LOOP  
    EXIT WHEN c_jobh_csr%NOTFOUND;  
    v_years_service := v_years_service + jobh_rec.v_years_in_job;  
  END LOOP;  
  SELECT MONTHS_BETWEEN(SYSDATE, hire_date)/12 INTO v_years_in_job  
  FROM    employees  
  WHERE   employee_id = p_emp_empid_type;  
  v_years_service := v_years_service + v_years_in_job;  
  RETURN ROUND(v_years_service);  
EXCEPTION  
  WHEN NO_DATA_FOUND THEN  
    RAISE_APPLICATION_ERROR(-20348,  
      'Employee with ID '|| p_emp_empid_type ||' does not exist.');
```

```
RETURN NULL;  
END get_years_service;  
/  
SHOW ERRORS  
  
FUNCTION get_years_service( Compiled.  
No Errors.
```

- b. Invoke the GET\_YEARS\_SERVICE function in a call to DBMS\_OUTPUT.PUT\_LINE for an employee with ID 999.

```
EXECUTE DBMS_OUTPUT.PUT_LINE(get_years_service (999))  
  
Error starting at line 1 in command:  
EXECUTE DBMS_OUTPUT.PUT_LINE(get_years_service (999))  
Error report:  
ORA-20348: Employee with ID 999 does not exist.  
ORA-06512: at "ORA70.GET_YEARS_SERVICE", line 22  
ORA-06512: at line 1
```



## Part A: Additional Practice 5 Solutions (continued)

- c. Display the number of years of service for employee 106 with  
DBMS\_OUTPUT.PUT\_LINE  
invoking the GET\_YEARS\_SERVICE function.

```
BEGIN
  DBMS_OUTPUT.PUT_LINE (
    'Employee 106 has worked ' || get_years_service(106) || ' years');
END;
/

anonymous block completed
Employee 106 has worked 9 years.
```

- d. Query the JOB\_HISTORY and EMPLOYEES tables for the specified employee to verify that the modifications are accurate.  
**Note:** The values represented in the results on this page may differ from those you get when you run these queries.

```
SELECT employee_id, job_id,
       MONTHS_BETWEEN(end_date, start_date)/12 duration
FROM   job_history;
```

EMPLOYEE_ID	JOB_ID	DURATION
106	IT_PROG	9.33964400388291517323775388291517323775
106	SY_ANAL	0
106	SY_ANAL	0.0109898633512544802867383512544802867384
106	SY_ANAL	0
102	IT_PROG	5.52956989247311827956989247311827956989
101	AC_ACCOUNT	4.09946236559139784946236559139784946237
101	AC_MGR	3.38172043010752688172043010752688172043
201	MK_REP	3.83870967741935483870967741935483870968
114	ST_CLERK	1.7688172043010752688172043010752688172
122	ST_CLERK	0.9973118279569892473118279569892473118283
200	AD_ASST	5.75
176	SA_REP	0.7688172043010752688172043010752688172042
176	SA_MAN	0.9973118279569892473118279569892473118283
200	AC_ACCOUNT	4.49731182795698924731182795698924731183

```
SELECT job_id, MONTHS_BETWEEN(SYSDATE, hire_date)/12 duration
FROM   employees
WHERE  employee_id = 106;
```

JOB_ID	DURATION
SY_ANAL	0

## Part A: Additional Practice 6 Solutions

6. In this exercise, create a program to retrieve the number of different jobs that an employee worked on during his or her service.
  - a. Create a stored function called GET\_JOB\_COUNT to retrieve the total number of different jobs on which an employee worked.

The function should accept the employee ID in a parameter, and return the number of different jobs that the employee worked on until now, including the present job. Add exception handling to account for an invalid employee ID.

**Hint:** Use the distinct job IDs from the JOB\_HISTORY table, and exclude the current job ID, if it is one of the job IDs on which the employee has already worked. Write a UNION of two queries and count the rows retrieved into a PL/SQL table. Use a FETCH with BULK COLLECT INTO to obtain the unique jobs for the employee.

```
CREATE OR REPLACE FUNCTION get_job_count(
  p_emp_empid_type IN employees.employee_id%TYPE) RETURN NUMBER IS
  TYPE jobs_table_type IS TABLE OF jobs.job_id%type;
  v_jobtab jobs_table_type;
  CURSOR c_empjob_csr IS
    SELECT job_id
    FROM job_history
    WHERE employee_id = p_emp_empid_type
    UNION
    SELECT job_id
    FROM employees
    WHERE employee_id = p_emp_empid_type;
BEGIN
  OPEN c_empjob_csr;
  FETCH c_empjob_csr BULK COLLECT INTO v_jobtab;
  CLOSE c_empjob_csr;
  RETURN v_jobtab.count;
EXCEPTION
  WHEN NO_DATA_FOUND THEN
    RAISE_APPLICATION_ERROR(-20348,
      'Employee with ID ' || p_emp_empid_type || ' does not exist!');
  RETURN NULL;
END get_job_count;
/
SHOW ERRORS

FUNCTION get_job_count( Compiled.
No Errors.
```

## Part A: Additional Practice 6 Solutions (continued)

- b. Invoke the function for an employee with ID 176.

```
BEGIN
  DBMS_OUTPUT.PUT_LINE('Employee 176 worked on ' ||
    get_job_count(176) || ' different jobs. ');
END;
/

Employee 176 worked on 2 different jobs.
PL/SQL procedure successfully completed.
```

## Part A: Additional Practice 7 Solutions

7. Create a package called EMPJOB\_PKG that contains your NEW\_JOB, ADD\_JOB\_HIST, and UPD\_JOBSAL procedures, as well as your GET\_YEARS\_SERVICE and GET\_JOB\_COUNT functions.
  - a. Create the package specification with all the subprogram constructs public. Move any subprogram local-defined types into the package specification.

```
CREATE OR REPLACE PACKAGE empjob_pkg IS
  TYPE jobs_table_type IS TABLE OF jobs.job_id%type;

  PROCEDURE add_job_hist(
    p_emp_id IN employees.employee_id%TYPE,
    p_new_jobid IN jobs.job_id%TYPE);

  FUNCTION get_job_count(
    p_emp_id IN employees.employee_id%TYPE) RETURN NUMBER;

  FUNCTION get_years_service(
    p_emp_id IN employees.employee_id%TYPE) RETURN NUMBER;

  PROCEDURE new_job(
    p_jobid IN jobs.job_id%TYPE,
    p_title IN jobs.job_title%TYPE,
    p_minsal IN jobs.min_salary%TYPE);

  PROCEDURE upd_jobsal(
    p_jobid IN jobs.job_id%type,
    p_new_minsal IN jobs.min_salary%type,
    p_new_maxsal IN jobs.max_salary%type);
END empjob_pkg;
/
SHOW ERRORS

PACKAGE empjob_pkg Compiled.
No Errors.
```

## Part A: Additional Practice 7 Solutions (continued)

- b. Create the package body with the subprogram implementation; remember to remove (from the subprogram implementations) any types that you moved into the package specification.

```
CREATE OR REPLACE PACKAGE BODY empjob_pkg IS
  PROCEDURE add_job_hist(
    p_emp_id IN employees.employee_id%TYPE,
    p_new_jobid IN jobs.job_id%TYPE) IS
  BEGIN
    INSERT INTO job_history
      SELECT employee_id, hire_date, SYSDATE, job_id, department_id
      FROM employees
      WHERE employee_id = p_emp_id;
    UPDATE employees
      SET hire_date = SYSDATE,
          job_id = p_new_jobid,
          salary = (SELECT min_salary + 500
                    FROM jobs
                    WHERE job_id = p_new_jobid)
      WHERE employee_id = p_emp_id;
    DBMS_OUTPUT.PUT_LINE ('Added employee ' || p_emp_id ||
      ' details to the JOB_HISTORY table');
    DBMS_OUTPUT.PUT_LINE ('Updated current job of employee ' ||
      p_emp_id || ' to ' || p_new_jobid);
  EXCEPTION
    WHEN NO_DATA_FOUND THEN
      RAISE_APPLICATION_ERROR (-20001, 'Employee does not exist!');
  END add_job_hist;

  FUNCTION get_job_count(
    p_emp_id IN employees.employee_id%TYPE) RETURN NUMBER IS
    v_jobtab jobs_table_type;
    CURSOR c_empjob_csr IS
      SELECT job_id
      FROM job_history
      WHERE employee_id = p_emp_id
      UNION
      SELECT job_id
      FROM employees
      WHERE employee_id = p_emp_id;
  BEGIN
    OPEN c_empjob_csr;
    FETCH c_empjob_csr BULK COLLECT INTO v_jobtab;
    CLOSE c_empjob_csr;
    RETURN v_jobtab.count;
  EXCEPTION
    WHEN NO_DATA_FOUND THEN
      RAISE_APPLICATION_ERROR(-20348,
        'Employee with ID ' || p_emp_id || ' does not exist!');
    RETURN 0;
  END get_job_count;
```

```

FUNCTION get_years_service(
  p_emp_id IN employees.employee_id%TYPE) RETURN NUMBER IS
  CURSOR c_jobh_csr IS
    SELECT MONTHS_BETWEEN(end_date, start_date)/12 v_years_in_job
    FROM job_history
    WHERE employee_id = p_emp_id;
  v_years_service NUMBER(2) := 0;
  v_years_in_job NUMBER(2) := 0;
BEGIN
  FOR jobh_rec IN c_jobh_csr
  LOOP
    EXIT WHEN c_jobh_csr%NOTFOUND;
    v_years_service := v_years_service + jobh_rec.v_years_in_job;
  END LOOP;
  SELECT MONTHS_BETWEEN(SYSDATE, hire_date)/12 INTO v_years_in_job
  FROM employees
  WHERE employee_id = p_emp_id;
  v_years_service := v_years_service + v_years_in_job;
  RETURN ROUND(v_years_service);
EXCEPTION
  WHEN NO_DATA_FOUND THEN
    RAISE_APPLICATION_ERROR(-20348,
      'Employee with ID ' || p_emp_id || ' does not exist. ');
    RETURN 0;
END get_years_service;

PROCEDURE new_job(
  p_jobid IN jobs.job_id%TYPE,
  p_title IN jobs.job_title%TYPE,
  p_minsal IN jobs.min_salary%TYPE) IS
  v_maxsal jobs.max_salary%TYPE := 2 * p_minsal;
BEGIN
  INSERT INTO jobs(job_id, job_title, min_salary, max_salary)
  VALUES (p_jobid, p_title, p_minsal, v_maxsal);
  DBMS_OUTPUT.PUT_LINE ('New row added to JOBS table:');
  DBMS_OUTPUT.PUT_LINE (p_jobid || ' ' || p_title || ' ' ||
    p_minsal || ' ' || v_maxsal);
END new_job;

PROCEDURE upd_jobsal(
  p_jobid IN jobs.job_id%type,
  p_new_minsal IN jobs.min_salary%type,
  p_new_maxsal IN jobs.max_salary%type) IS
  v_dummy PLS_INTEGER;
  e_resource_busy EXCEPTION;
  e_sal_error EXCEPTION;
  PRAGMA EXCEPTION_INIT (e_resource_busy , -54);
BEGIN
  IF (p_new_maxsal < p_new_minsal) THEN
    RAISE e_sal_error;
  END IF;
  SELECT 1 INTO v_dummy
  FROM jobs

```

```

WHERE job_id = p_jobid
FOR UPDATE OF min_salary NOWAIT;
UPDATE jobs
  SET min_salary = p_new_minsal,
      max_salary = p_new_maxsal
WHERE job_id = p_jobid;
EXCEPTION
  WHEN e_resource_busy THEN
    RAISE_APPLICATION_ERROR (-20001,
      'Job information is currently locked, try later.');
```

```

  WHEN NO_DATA_FOUND THEN
    RAISE_APPLICATION_ERROR(-20001, 'This job ID does not exist');
```

```

  WHEN e_sal_error THEN
    RAISE_APPLICATION_ERROR(-20001,
      'Data error: Max salary should be more than min salary');
```

```

END upd_jobsal;
END empjob_pkg;
/
SHOW ERRORS

PACKAGE BODY empjob_pkg Compiled.
No Errors.
```

- c. Invoke your EMPJOB\_PKG.NEW\_JOB procedure to create a new job with ID PR\_MAN, job title Public Relations Manager, and salary 6250.

```

EXECUTE empjob_pkg.new_job('PR_MAN', 'Public Relations Manager', 6250)

anonymous block completed
New row added to JOBS table:
PR_MAN Public Relations Manager 6250 12500.
```

## Part A: Additional Practice 7 Solutions (continued)

- d. Invoke your EMPJOB\_PKG.ADD\_JOB\_HIST procedure to modify the job of employee ID 110 to job ID PR\_MAN.

**Note:** You need to disable the UPDATE\_JOB\_HISTORY trigger before you execute the ADD\_JOB\_HIST procedure, and reenable the trigger after you have executed the procedure.

```
ALTER TRIGGER update_job_history DISABLE;
EXECUTE empjob_pkg.add_job_hist(110, 'PR_MAN')
ALTER TRIGGER update_job_history ENABLE;

ALTER TRIGGER update_job_history succeeded.
anonymous block completed
Added employee 110 details to the JOB_HISTORY table
Updated current job of employee 110 to PR_MAN

ALTER TRIGGER update_job_history succeeded.
```

- e. Query the JOBS, JOB\_HISTORY, and EMPLOYEES tables to verify the results.

```
SELECT * FROM jobs WHERE job_id = 'PR_MAN';
SELECT * FROM job_history WHERE employee_id = 110;
SELECT job_id, salary FROM employees WHERE employee_id = 110;
```

JOB_ID	JOB_TITLE	MIN_SALARY	MAX_SALARY
PR_MAN	Public Relations Manager	6250	12500

EMPLOYEE_ID	START_DATE	END_DATE	JOB_ID	DEPARTMENT_ID
110	28-SEP-97	11-JUN-07	FI_ACCOUNT	100

JOB_ID	SALARY
PR_MAN	6750



## Part A: Additional Practice 8 Solutions

8. In this exercise, create a trigger to ensure that the minimum and maximum salaries of a job are never modified such that the salary of an existing employee with that job ID is outside the new range specified for the job.
  - a. Create a trigger called CHECK\_SAL\_RANGE that is fired before every row that is updated in the MIN\_SALARY and MAX\_SALARY columns in the JOBS table. For any minimum or maximum salary value that is changed, check whether the salary of any existing employee with that job ID in the EMPLOYEES table falls within the new range of salaries specified for this job ID. Include exception handling to cover a salary range change that affects the record of any existing employee.

```
CREATE OR REPLACE TRIGGER check_sal_range
BEFORE UPDATE OF min_salary, max_salary ON jobs
FOR EACH ROW
DECLARE
    v_minsal employees.salary%TYPE;
    v_maxsal employees.salary%TYPE;
    e_invalid_salrange EXCEPTION;
BEGIN
    SELECT MIN(salary), MAX(salary) INTO v_minsal, v_maxsal
    FROM employees
    WHERE job_id = :NEW.job_id;
    IF (v_minsal < :NEW.min_salary) OR (v_maxsal > :NEW.max_salary) THEN
        RAISE e_invalid_salrange;
    END IF;
EXCEPTION
    WHEN e_invalid_salrange THEN
        RAISE_APPLICATION_ERROR(-20550,
            'Employees exist whose salary is out of the specified range. '||
            'Therefore the specified salary range cannot be updated.');
```

```
END check_sal_range;
/
SHOW ERRORS

TRIGGER check_sal_range Compiled.
No Errors.
```

**Part A: Additional Practice 8 Solutions (continued)**

- b. Test the trigger using the SY\_ANAL job, setting the new minimum salary to 5000 and the new maximum salary to 7000. Before you make the change, write a query to display the current salary range for the SY\_ANAL job ID, and another query to display the employee ID, last name, and salary for the same job ID. After the update, query the change (if any) to the JOBS table for the specified job ID.

```
SELECT * FROM jobs
WHERE job_id = 'SY_ANAL';
```

JOB_ID	JOB_TITLE	MIN_SALARY	MAX_SALARY
SY_ANAL	System Analyst	7000	14000

```
SELECT employee_id, last_name, salary
FROM employees
WHERE job_id = 'SY_ANAL';
```

EMPLOYEE_ID	LAST_NAME	SALARY
106	Pataballa	6500

```
UPDATE jobs
SET min_salary = 5000, max_salary = 7000
WHERE job_id = 'SY_ANAL';
```

1 row updated.

```
SELECT * FROM jobs
WHERE job_id = 'SY_ANAL';
```

JOB_ID	JOB_TITLE	MIN_SALARY	MAX_SALARY
SY_ANAL	System Analyst	5000	7000

- c. Using the job SY\_ANAL, set the new minimum salary to 7000 and the new maximum salary to 18000. Explain the results.

```
UPDATE jobs
SET min_salary = 7000, max_salary = 18000
WHERE job_id = 'SY_ANAL';
```

Error starting at line 1 in command:

```
UPDATE jobs
SET min_salary = 7000, max_salary = 18000
WHERE job_id = 'SY_ANAL'
```

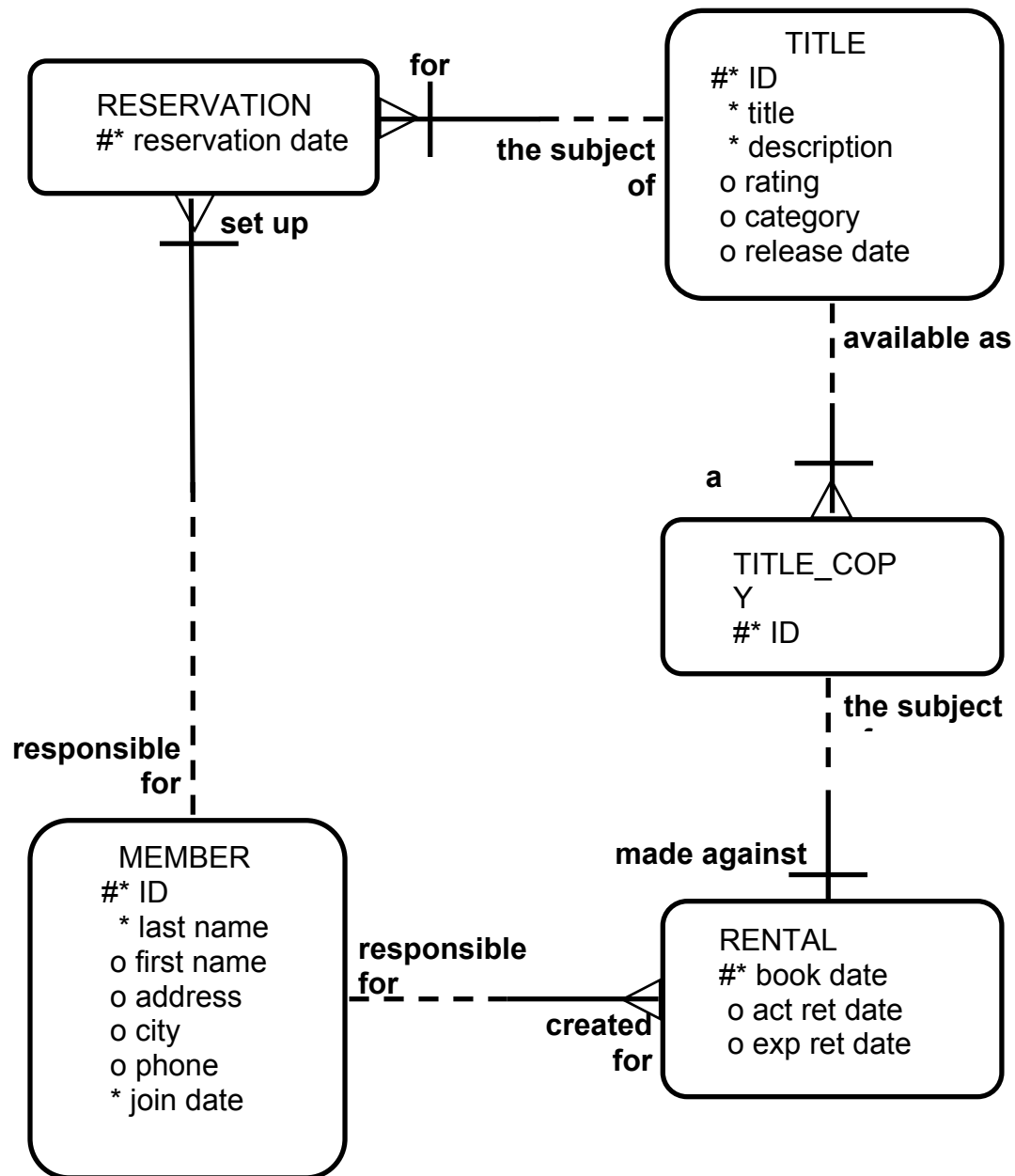
Error report:

```
SQL Error: ORA-20550: Employees exist whose salary is out of the
specified range. Therefore the specified salary range cannot be updated.
ORA-06512: at "ORA61.CHECK_SAL_RANGE", line 14
ORA-04088: error during execution of trigger 'ORA61.CHECK_SAL_RANGE'
```

## Part A: Additional Practice 8 Solutions (continued)

The update fails to change the salary range due to the functionality provided by the `CHECK_SAL_RANGE` trigger because employee 106 who has the `SY_ANAL` job ID has a salary of 6500, which is less than the minimum salary for the new salary range specified in the `UPDATE` statement.

## Part B: Entity Relationship Diagram



## Part B (continued)

In this case study, create a package named VIDEO\_PKG that contains procedures and functions for a video store application. This application enables customers to become a member of the video store. Any member can rent movies, return rented movies, and reserve movies. Additionally, create a trigger to ensure that any data in the video tables is modified only during business hours.

Create the package by using *iSQL\*Plus* and use the DBMS\_OUTPUT Oracle-supplied package to display messages.

The video store database contains the following tables: TITLE, TITLE\_COPY, RENTAL, RESERVATION, and MEMBER. The entity relationship diagram is shown on the previous page.

## Part B: Additional Practice 1 Solutions

1. Load and execute the D:\labs\PLPU\labs\buildvid1.sql script to create all the required tables and sequences that are needed for this exercise.

```
SET ECHO OFF
/* Script to build the Video Application (Part 1 - buildvid1.sql)
   for the Oracle Introduction to Oracle with Procedure Builder course.
   Created by: Debby Kramer Creation date: 12/10/95
   Last updated: 2/13/96
   Modified by Nagavalli Pataballa on 26-APR-2001
   For the course Introduction to Oracle9i: PL/SQL
   This part of the script creates tables and sequences that are used
   by Part B of the Additional Practices of the course.
   Ignore the errors which appear due to dropping of table.
*/

DROP TABLE rental CASCADE CONSTRAINTS;
DROP TABLE reservation CASCADE CONSTRAINTS;
DROP TABLE title_copy CASCADE CONSTRAINTS;
DROP TABLE title CASCADE CONSTRAINTS;
DROP TABLE member CASCADE CONSTRAINTS;

PROMPT Please wait while tables are created....

CREATE TABLE MEMBER
  (member_id  NUMBER (10)           CONSTRAINT member_id_pk PRIMARY KEY
  , last_name  VARCHAR2(25)
    CONSTRAINT member_last_nn NOT NULL
  , first_name VARCHAR2(25)
  , address    VARCHAR2(100)
  , city       VARCHAR2(30)
  , phone      VARCHAR2(25)
  , join_date  DATE DEFAULT SYSDATE
    CONSTRAINT join_date_nn NOT NULL)
/

CREATE TABLE TITLE
  (title_id  NUMBER(10)
    CONSTRAINT title_id_pk PRIMARY KEY
  , title     VARCHAR2(60)
    CONSTRAINT title_nn NOT NULL
  , description VARCHAR2(400)
    CONSTRAINT title_desc_nn NOT NULL
  , rating    VARCHAR2(4)
    CONSTRAINT title_rating_ck CHECK (rating IN
('G','PG','R','NC17','NR'))
  , category  VARCHAR2(20) DEFAULT 'DRAMA'
    CONSTRAINT title_categ_ck CHECK (category IN
('DRAMA','COMEDY','ACTION','CHILD','SCIFI','DOCUMENTARY'))
  , release_date DATE)
/
```

## Part B: Additional Practice 1 Solutions (continued)

```
CREATE TABLE TITLE_COPY
  (copy_id    NUMBER(10)
  , title_id  NUMBER(10)
    CONSTRAINT copy_title_id_fk
      REFERENCES title(title_id)
  , status    VARCHAR2(15)
    CONSTRAINT copy_status_nn NOT NULL
    CONSTRAINT copy_status_ck CHECK (status IN ('AVAILABLE',
'DESTROYED',
                                     'RENTED', 'RESERVED'))
  , CONSTRAINT copy_title_id_pk  PRIMARY KEY(copy_id, title_id))
/
CREATE TABLE RENTAL
  (book_date DATE DEFAULT SYSDATE
  , copy_id   NUMBER(10)
  , member_id NUMBER(10)
    CONSTRAINT rental_mbr_id_fk REFERENCES member(member_id)
  , title_id  NUMBER(10)
  , act_ret_date DATE
  , exp_ret_date DATE DEFAULT SYSDATE+2
  , CONSTRAINT rental_copy_title_id_fk FOREIGN KEY (copy_id, title_id)
      REFERENCES title_copy(copy_id,title_id)
  , CONSTRAINT rental_id_pk PRIMARY KEY(book_date, copy_id, title_id,
member_id))
/
CREATE TABLE RESERVATION
  (res_date  DATE
  , member_id NUMBER(10)
  , title_id  NUMBER(10)
  , CONSTRAINT res_id_pk PRIMARY KEY(res_date, member_id, title_id))
/

PROMPT Tables created.
DROP SEQUENCE title_id_seq;
DROP SEQUENCE member_id_seq;

PROMPT Creating Sequences...
CREATE SEQUENCE member_id_seq
  START WITH 101
  NOCACHE

CREATE SEQUENCE title_id_seq
  START WITH 92
  NOCACHE
/

PROMPT Sequences created.

PROMPT Run buildvid2.sql now to populate the above tables.
```

## Part B: Additional Practice 2 Solutions

2. Load and execute the D:\labs\PLPU\labs\buildvid2.sql script to populate all the tables created by the buildvid1.sql script.

```
/* Script to build the Video Application (Part 2 - buildvid2.sql)
   This part of the script populates the tables that are created using
   buildvid1.sql
   These are used by Part B of the Additional Practices of the course.
   You should run the script buildvid1.sql before running this script to
   create the above tables.
*/

INSERT INTO member
VALUES (member_id_seq.NEXTVAL, 'Velasquez', 'Carmen',
      '283 King Street', 'Seattle', '587-99-6666', '03-MAR-90');
INSERT INTO member
VALUES (member_id_seq.NEXTVAL, 'Ngao', 'LaDoris',
      '5 Modrany', 'Bratislava', '586-355-8882', '08-MAR-90');
INSERT INTO member
VALUES (member_id_seq.NEXTVAL, 'Nagayama', 'Midori',
      '68 Via Centrale', 'Sao Paolo', '254-852-5764', '17-JUN-91');
INSERT INTO member
VALUES (member_id_seq.NEXTVAL, 'Quick-To-See', 'Mark',
      '6921 King Way', 'Lagos', '63-559-777', '07-APR-90');
INSERT INTO member
VALUES (member_id_seq.NEXTVAL, 'Ropeburn', 'Audry',
      '86 Chu Street', 'Hong Kong', '41-559-87', '04-MAR-90');
INSERT INTO member
VALUES (member_id_seq.NEXTVAL, 'Urguhart', 'Molly',
      '3035 Laurier Blvd.', 'Quebec', '418-542-9988', '18-JAN-91');
INSERT INTO member
VALUES (member_id_seq.NEXTVAL, 'Menchu', 'Roberta',
      'Boulevard de Waterloo 41', 'Brussels', '322-504-2228', '14-MAY-90');
INSERT INTO member
VALUES (member_id_seq.NEXTVAL, 'Biri', 'Ben',
      '398 High St.', 'Columbus', '614-455-9863', '07-APR-90');
INSERT INTO member
VALUES (member_id_seq.NEXTVAL, 'Catchpole', 'Antoinette',
      '88 Alfred St.', 'Brisbane', '616-399-1411', '09-FEB-92');

COMMIT;
```



**Part B: Additional Practice 2 Solutions (continued)**

```

INSERT INTO TITLE (title_id, title, description, rating, category,
release_date)
VALUES (TITLE_ID_SEQ.NEXTVAL, 'Willie and Christmas Too',
'All of Willie's friends made a Christmas list for Santa, but Willie
has yet to create his own wish list.', 'G', 'CHILD', '05-OCT-95');
INSERT INTO TITLE (title_id, title, description, rating, category,
release_date)
VALUES (TITLE_ID_SEQ.NEXTVAL, 'Alien Again', 'Another installment of
science fiction history. Can the heroine save the planet from the alien
life form?', 'R', 'SCIFI', '19-MAY-95');
INSERT INTO TITLE (title_id, title, description, rating, category,
release_date)
VALUES (TITLE_ID_SEQ.NEXTVAL, 'The Glob', 'A meteor crashes near a
small American town and unleashes carivorous goo in this classic.', 'NR',
'SCIFI', '12-AUG-95');
INSERT INTO TITLE (title_id, title, description, rating, category,
release_date)
VALUES (TITLE_ID_SEQ.NEXTVAL, 'My Day Off', 'With a little luck and a
lot of ingenuity, a teenager skips school for a day in New York.', 'PG',
'COMEDY', '12-JUL-95');
INSERT INTO TITLE (title_id, title, description, rating, category,
release_date)
VALUES (TITLE_ID_SEQ.NEXTVAL, 'Miracles on Ice', 'A six-year-old has
doubts about Santa Claus. But she discovers that miracles really do
exist.', 'PG', 'DRAMA', '12-SEP-95');
INSERT INTO TITLE (title_id, title, description, rating, category,
release_date)
VALUES (TITLE_ID_SEQ.NEXTVAL, 'Soda Gang', 'After discovering a cached
of drugs, a young couple find themselves pitted against a vicious gang.',
'NR', 'ACTION', '01-JUN-95');
INSERT INTO title (title_id, title, description, rating, category,
release_date)
VALUES (TITLE_ID_SEQ.NEXTVAL, 'Interstellar Wars', 'Futuristic
interstellar action movie. Can the rebels save the humans from the evil
Empire?', 'PG', 'SCIFI', '07-JUL-77');

COMMIT;

INSERT INTO title_copy VALUES (1,92, 'AVAILABLE');
INSERT INTO title_copy VALUES (1,93, 'AVAILABLE');
INSERT INTO title_copy VALUES (2,93, 'RENTED');
INSERT INTO title_copy VALUES (1,94, 'AVAILABLE');
INSERT INTO title_copy VALUES (1,95, 'AVAILABLE');
INSERT INTO title_copy VALUES (2,95, 'AVAILABLE');
INSERT INTO title_copy VALUES (3,95, 'RENTED');
INSERT INTO title_copy VALUES (1,96, 'AVAILABLE');
INSERT INTO title_copy VALUES (1,97, 'AVAILABLE');
INSERT INTO title_copy VALUES (1,98, 'RENTED');
INSERT INTO title_copy VALUES (2,98, 'AVAILABLE');

COMMIT;

```

## Part B: Additional Practice 2 Solutions (continued)

```
INSERT INTO reservation VALUES (sysdate-1, 101, 93);
INSERT INTO reservation VALUES (sysdate-2, 106, 102);

COMMIT;

INSERT INTO rental VALUES (sysdate-1, 2, 101, 93, null, sysdate+1);
INSERT INTO rental VALUES (sysdate-2, 3, 102, 95, null, sysdate);
INSERT INTO rental VALUES (sysdate-3, 1, 101, 98, null, sysdate-1);
INSERT INTO rental VALUES (sysdate-4, 1, 106, 97, sysdate-2, sysdate-2);
INSERT INTO rental VALUES (sysdate-3, 1, 101, 92, sysdate-2, sysdate-1);

COMMIT;

PROMPT ** Tables built and data loaded **
```

## Part B: Additional Practice 3 Solutions

3. Create a package named VIDEO\_PKG with the following procedures and functions:
  - a. NEW\_MEMBER: A public procedure that adds a new member to the MEMBER table. For the member ID number, use the sequence MEMBER\_ID\_SEQ. For the join date, use SYSDATE. Pass all the other values to be inserted into a new row as parameters.
  - b. NEW\_RENTAL: An overloaded public function to record a new rental. Pass the title ID number for the video that a customer wants to rent, and either the customer's last name or his or her member ID number into the function. The function should return the due date for the video. Due dates are three days from the date the video is rented. If the status for a movie requested is listed as AVAILABLE in the TITLE\_COPY table for one copy of this title, then update this TITLE\_COPY table and set the status to RENTED. If there is no copy available, the function must return NULL. Then, insert a new record into the RENTAL table identifying the booked date as today's date, the copy ID number, the member ID number, the title ID number, and the expected return date. Be aware of multiple customers with the same last name. In this case, have the function return NULL, and display a list of the customers' names that match and their ID numbers.
  - c. RETURN\_MOVIE: A public procedure that updates the status of a video (available, rented, or damaged) and sets the return date. Pass the title ID, the copy ID, and the status to this procedure. Check whether there are reservations for that title, and display a message, if it is reserved. Update the RENTAL table and set the actual return date to today's date. Update the status in the TITLE\_COPY table based on the status parameter passed into the procedure.
  - d. RESERVE\_MOVIE: A private procedure that executes only if all the video copies requested in the NEW\_RENTAL procedure have a status of RENTED. Pass the member ID number and the title ID number to this procedure. Insert a new record into the RESERVATION table and record the reservation date, member ID number, and title ID number. Print a message indicating that a movie is reserved and its expected date of return.
  - e. EXCEPTION\_HANDLER: A private procedure that is called from the exception handler of the public programs. Pass the SQLCODE number to this procedure, and the name of the program (as a text string) where the error occurred. Use RAISE\_APPLICATION\_ERROR to raise a customized error. Start with a unique key violation (-1) and foreign key violation (-2292). Allow the exception handler to raise a generic error for any other errors.

## Part B: Additional Practice 3 Solutions (continued)

### VIDEO\_PKG Package Specification

```
CREATE OR REPLACE PACKAGE video_pkg IS
  PROCEDURE new_member
    (p_lname      IN member.last_name%TYPE,
     p_fname      IN member.first_name%TYPE   DEFAULT NULL,
     p_address    IN member.address%TYPE     DEFAULT NULL,
     p_city       IN member.city%TYPE        DEFAULT NULL,
     p_phone      IN member.phone%TYPE       DEFAULT NULL);

  FUNCTION new_rental
    (p_memberid   IN rental.member_id%TYPE,
     p_titleid    IN rental.title_id%TYPE)
    RETURN DATE;

  FUNCTION new_rental
    (p_membername IN member.last_name%TYPE,
     p_titleid    IN rental.title_id%TYPE)
    RETURN DATE;

  PROCEDURE return_movie
    (p_titleid    IN rental.title_id%TYPE,
     p_copyid     IN rental.copy_id%TYPE,
     p_sts        IN title_copy.status%TYPE);
END video_pkg;
/
SHOW ERRORS

PACKAGE video_pkg Compiled.
No Errors.
```

### VIDEO\_PKG Package Body

```
CREATE OR REPLACE PACKAGE BODY video_pkg IS
  PROCEDURE exception_handler(errcode IN NUMBER, context IN VARCHAR2) IS
  BEGIN
    IF errcode = -1 THEN
      RAISE_APPLICATION_ERROR(-20001,
        'The number is assigned to this member is already in use, ' ||
        'try again. ');
    ELSIF errcode = -2291 THEN
      RAISE_APPLICATION_ERROR(-20002, context ||
        ' has attempted to use a foreign key value that is invalid');
    ELSE
      RAISE_APPLICATION_ERROR(-20999, 'Unhandled error in ' ||
        context || '. Please contact your application ' ||
        'administrator with the following information: '
        || CHR(13) || SQLERRM);
    END IF;
  END exception_handler;
END;
```

**Part B: Additional Practice 3 Solutions (continued)**

```

PROCEDURE reserve_movie
(memberid IN reservation.member_id%TYPE,
titleid IN reservation.title_id%TYPE) IS
CURSOR rented_csr IS
    SELECT exp_ret_date
    FROM rental
    WHERE title_id = titleid
    AND act_ret_date IS NULL;
BEGIN
    INSERT INTO reservation (res_date, member_id, title_id)
    VALUES (SYSDATE, memberid, titleid);
    COMMIT;
    FOR rented_rec IN rented_csr LOOP
        DBMS_OUTPUT.PUT_LINE('Movie reserved. Expected back on: '
        || rented_rec.exp_ret_date);
        EXIT WHEN rented_csr%found;
    END LOOP;
EXCEPTION
    WHEN OTHERS THEN
        exception_handler(SQLCODE, 'RESERVE_MOVIE');
END reserve_movie;

PROCEDURE return_movie(
titleid IN rental.title_id%TYPE,
copyid IN rental.copy_id%TYPE,
sts IN title_copy.status%TYPE) IS
v_dummy VARCHAR2(1);
CURSOR res_csr IS
    SELECT *
    FROM reservation
    WHERE title_id = titleid;
BEGIN
    SELECT '' INTO v_dummy
    FROM title
    WHERE title_id = titleid;
    UPDATE rental
    SET act_ret_date = SYSDATE
    WHERE title_id = titleid
    AND copy_id = copyid AND act_ret_date IS NULL;
    UPDATE title_copy
    SET status = UPPER(sts)
    WHERE title_id = titleid AND copy_id = copyid;
    FOR res_rec IN res_csr LOOP
        IF res_csr%FOUND THEN
            DBMS_OUTPUT.PUT_LINE('Put this movie on hold -- ' ||
            'reserved by member #' || res_rec.member_id);
        END IF;
    END LOOP;
EXCEPTION
    WHEN OTHERS THEN
        exception_handler(SQLCODE, 'RETURN_MOVIE');
END return_movie;

```

## Part B: Additional Practice 3 Solutions (continued)

```
FUNCTION new_rental(
  memberid IN rental.member_id%TYPE,
  titleid IN rental.title_id%TYPE) RETURN DATE IS
  CURSOR copy_csr IS
    SELECT * FROM title_copy
    WHERE title_id = titleid
    FOR UPDATE;
  flag BOOLEAN := FALSE;
BEGIN

  FOR copy_rec IN copy_csr LOOP
    IF copy_rec.status = 'AVAILABLE' THEN
      UPDATE title_copy
        SET status = 'RENTED'
        WHERE CURRENT OF copy_csr;
      INSERT INTO rental(book_date, copy_id, member_id,
                        title_id, exp_ret_date)
        VALUES (SYSDATE, copy_rec.copy_id, memberid,
                titleid, SYSDATE + 3);

      flag := TRUE;
      EXIT;
    END IF;
  END LOOP;
  COMMIT;
  IF flag THEN
    RETURN (SYSDATE + 3);
  ELSE
    reserve_movie(memberid, titleid);
    RETURN NULL;
  END IF;
EXCEPTION
  WHEN OTHERS THEN
    exception_handler(SQLCODE, 'NEW_RENTAL');
END new_rental;

FUNCTION new_rental(
  membername IN member.last_name%TYPE,
  titleid IN rental.title_id%TYPE) RETURN DATE IS
  CURSOR copy_csr IS
    SELECT * FROM title_copy
    WHERE title_id = titleid
    FOR UPDATE;
  flag BOOLEAN := FALSE;
  memberid member.member_id%TYPE;
  CURSOR member_csr IS
    SELECT member_id, last_name, first_name
    FROM member
    WHERE LOWER(last_name) = LOWER(membername)
    ORDER BY last_name, first_name;
```

## Part B: Additional Practice 3 Solutions (continued)

```
BEGIN
  SELECT member_id INTO memberid
    FROM member
   WHERE lower(last_name) = lower(membername);
  FOR copy_rec IN copy_csr LOOP
    IF copy_rec.status = 'AVAILABLE' THEN
      UPDATE title_copy
        SET status = 'RENTED'
       WHERE CURRENT OF copy_csr;
      INSERT INTO rental (book_date, copy_id, member_id,
                        title_id, exp_ret_date)
        VALUES (SYSDATE, copy_rec.copy_id, memberid,
                titleid, SYSDATE + 3);

      flag := TRUE;
      EXIT;
    END IF;
  END LOOP;
  COMMIT;
  IF flag THEN
    RETURN(SYSDATE + 3);
  ELSE
    reserve_movie(memberid, titleid);
    RETURN NULL;
  END IF;
EXCEPTION
  WHEN TOO_MANY_ROWS THEN
    DBMS_OUTPUT.PUT_LINE(
      'Warning! More than one member by this name.');
```

```
  FOR member_rec IN member_csr LOOP
    DBMS_OUTPUT.PUT_LINE(member_rec.member_id || CHR(9) ||
      member_rec.last_name || ', ' || member_rec.first_name);
  END LOOP;
  RETURN NULL;
  WHEN OTHERS THEN
    exception_handler(SQLCODE, 'NEW_RENTAL');
END new_rental;

PROCEDURE new_member(
  lname      IN member.last_name%TYPE,
  fname      IN member.first_name%TYPE    DEFAULT NULL,
  address    IN member.address%TYPE       DEFAULT NULL,
  city       IN member.city%TYPE          DEFAULT NULL,
  phone      IN member.phone%TYPE         DEFAULT NULL) IS
BEGIN
  INSERT INTO member(member_id, last_name, first_name,
                    address, city, phone, join_date)
    VALUES(member_id_seq.NEXTVAL, lname, fname,
            address, city, phone, SYSDATE);
  COMMIT;
CREATE OR REPLACE PACKAGE BODY video_pkg IS
  PROCEDURE exception_handler(errcode IN  NUMBER, p_context IN VARCHAR2)
IS
```

```

BEGIN
  IF errcode = -1 THEN
    RAISE_APPLICATION_ERROR(-20001,
      'The number is assigned to this member is already in use, ' ||
      'try again. ');
  ELSIF errcode = -2291 THEN
    RAISE_APPLICATION_ERROR(-20002, p_context ||
      ' has attempted to use a foreign key value that is invalid');
  ELSE
    RAISE_APPLICATION_ERROR(-20999, 'Unhandled error in ' ||
      p_context || '. Please contact your application ' ||
      'administrator with the following information: '
      || CHR(13) || SQLERRM);
  END IF;
END exception_handler;

PROCEDURE reserve_movie
(p_memberid IN reservation.member_id%TYPE,
 p_titleid  IN reservation.title_id%TYPE) IS
CURSOR c_rented_csr IS
  SELECT exp_ret_date
  FROM rental
  WHERE title_id = p_titleid
  AND act_ret_date IS NULL;
BEGIN
  INSERT INTO reservation (res_date, member_id, title_id)
  VALUES (SYSDATE, p_memberid, p_titleid);
  COMMIT;
  FOR rented_rec IN c_rented_csr LOOP
    DBMS_OUTPUT.PUT_LINE('Movie reserved. Expected back on: '
      || rented_rec.exp_ret_date);
    EXIT WHEN c_rented_csr%found;
  END LOOP;
EXCEPTION
  WHEN OTHERS THEN
    exception_handler(SQLCODE, 'RESERVE_MOVIE');
END reserve_movie;

PROCEDURE return_movie(
  p_titleid IN rental.title_id%TYPE,
  p_copyid  IN rental.copy_id%TYPE,
  p_sts IN title_copy.status%TYPE) IS
  v_dummy VARCHAR2(1);
  CURSOR c_res_csr IS
    SELECT *
    FROM reservation
    WHERE title_id = p_titleid;
BEGIN
  SELECT '' INTO v_dummy
  FROM title
  WHERE title_id = p_titleid;
  UPDATE rental
  SET act_ret_date = SYSDATE
  WHERE title_id = p_titleid

```



```

        AND copy_id = p_copyid AND act_ret_date IS NULL;
    UPDATE title_copy
        SET status = UPPER(p_sts)
        WHERE title_id = p_titleid AND copy_id = p_copyid;
    FOR res_rec IN c_res_csr LOOP
        IF c_res_csr%FOUND THEN
            DBMS_OUTPUT.PUT_LINE('Put this movie on hold -- ' ||
                'reserved by member #' || res_rec.member_id);
        END IF;
    END LOOP;
EXCEPTION
    WHEN OTHERS THEN
        exception_handler(SQLCODE, 'RETURN_MOVIE');
END return_movie;

FUNCTION new_rental(
    p_memberid IN rental.member_id%TYPE,
    p_titleid IN rental.title_id%TYPE) RETURN DATE IS
    CURSOR c_copy_csr IS
        SELECT * FROM title_copy
        WHERE title_id = p_titleid
        FOR UPDATE;
    v_flag BOOLEAN := FALSE;
BEGIN
    FOR copy_rec IN c_copy_csr LOOP
        IF copy_rec.status = 'AVAILABLE' THEN
            UPDATE title_copy
                SET status = 'RENTED'
                WHERE CURRENT OF c_copy_csr;
            INSERT INTO rental(book_date, copy_id, member_id,
                title_id, exp_ret_date)
            VALUES (SYSDATE, copy_rec.copy_id, p_memberid,
                p_titleid, SYSDATE + 3);

            v_flag := TRUE;
            EXIT;
        END IF;
    END LOOP;
    COMMIT;
    IF v_flag THEN
        RETURN (SYSDATE + 3);
    ELSE
        reserve_movie(p_memberid, p_titleid);
        RETURN NULL;
    END IF;
EXCEPTION
    WHEN OTHERS THEN
        exception_handler(SQLCODE, 'NEW_RENTAL');
        RETURN NULL;
END new_rental;

FUNCTION new_rental(
    p_membername IN member.last_name%TYPE,
    p_titleid IN rental.title_id%TYPE) RETURN DATE IS
    CURSOR c_copy_csr IS

```

```

        SELECT * FROM title_copy
        WHERE title_id = p_titleid
        FOR UPDATE;
v_flag BOOLEAN := FALSE;
v_memberid member.member_id%TYPE;
CURSOR c_member_csr IS
    SELECT member_id, last_name, first_name
    FROM member
    WHERE LOWER(last_name) = LOWER(p_membername)
    ORDER BY last_name, first_name;
BEGIN
    SELECT member_id INTO v_memberid
    FROM member
    WHERE lower(last_name) = lower(p_membername);
    FOR copy_rec IN c_copy_csr LOOP
        IF copy_rec.status = 'AVAILABLE' THEN
            UPDATE title_copy
            SET status = 'RENTED'
            WHERE CURRENT OF c_copy_csr;
            INSERT INTO rental (book_date, copy_id, member_id,
                                title_id, exp_ret_date)
            VALUES (SYSDATE, copy_rec.copy_id, v_memberid,
                    p_titleid, SYSDATE + 3);

            v_flag := TRUE;
            EXIT;
        END IF;
    END LOOP;
    COMMIT;
    IF v_flag THEN
        RETURN(SYSDATE + 3);
    ELSE
        reserve_movie(v_memberid, p_titleid);
        RETURN NULL;
    END IF;
EXCEPTION
    WHEN TOO_MANY_ROWS THEN
        DBMS_OUTPUT.PUT_LINE(
            'Warning! More than one member by this name.');
```

```

    FOR member_rec IN c_member_csr LOOP
        DBMS_OUTPUT.PUT_LINE(member_rec.member_id || CHR(9) ||
            member_rec.last_name || ', ' || member_rec.first_name);
    END LOOP;
    RETURN NULL;
    WHEN OTHERS THEN
        exception_handler(SQLCODE, 'NEW_RENTAL');
        RETURN NULL;
END new_rental;

PROCEDURE new_member(
    p_lname      IN member.last_name%TYPE,
    p_fname      IN member.first_name%TYPE      DEFAULT NULL,
    p_address     IN member.address%TYPE        DEFAULT NULL,
    p_city        IN member.city%TYPE           DEFAULT NULL,
    p_phone      IN member.phone%TYPE          DEFAULT NULL) IS
```

```

BEGIN
  INSERT INTO member(member_id, last_name, first_name,
                     address, city, phone, join_date)
    VALUES(member_id_seq.NEXTVAL, p_lname, p_fname,
           p_address, p_city, p_phone, SYSDATE);
  COMMIT;
EXCEPTION
  WHEN OTHERS THEN
    exception_handler(SQLCODE, 'NEW_MEMBER');
END new_member;
END video_pkg;
/
SHOW ERRORS

PACKAGE BODY video_pkg Compiled.
No Errors.

```

## Part B: Additional Practice 4 Solutions

4. Use the following scripts located in the E:\labs\PLPU\soln directory to test your routines:

a. Add two members using sol\_apb\_04\_a.sql.

```
EXECUTE video_pkg.new_member('Haas', 'James', 'Chestnut Street',  
'Boston', '617-123-4567')  
EXECUTE video_pkg.new_member('Biri', 'Allan', 'Hiawatha Drive', 'New  
York', '516-123-4567')  
  
anonymous block completed  
anonymous block completed.
```

b. Add new video rentals using sol\_apb\_04\_b.sql.

```
EXEC DBMS_OUTPUT.PUT_LINE(video_pkg.new_rental(110, 98))  
EXEC DBMS_OUTPUT.PUT_LINE(video_pkg.new_rental(109, 93))  
EXEC DBMS_OUTPUT.PUT_LINE(video_pkg.new_rental(107, 98))  
EXEC DBMS_OUTPUT.PUT_LINE(video_pkg.new_rental('Biri', 97))  
EXEC DBMS_OUTPUT.PUT_LINE(video_pkg.new_rental(97, 97))  
  
anonymous block completed  
14-JUN-07  
  
anonymous block completed  
14-JUN-07  
  
anonymous block completed  
Movie reserved. Expected back on: 10-JUN-07  
  
anonymous block completed  
Warning! More than one member by this name.  
111 Biri, Allan  
108 Biri, Ben  
  
Error starting at line 5 in command:  
EXEC DBMS_OUTPUT.PUT_LINE(video_pkg.new_rental(97, 97))  
Error report:  
ORA-20002: NEW_RENTAL has attempted to use a foreign key value that is  
invalid  
ORA-06512: at "ORA61.VIDEO_PKG", line 9  
ORA-06512: at "ORA61.VIDEO_PKG", line 103  
ORA-06512: at line 1
```

## Part B: Additional Practice 4 Solutions (continued)

c. Return movies by using the sol\_apb\_04\_c.sql script.

```
EXECUTE video_pkg.return_movie(98, 1, 'AVAILABLE')
EXECUTE video_pkg.return_movie(95, 3, 'AVAILABLE')
EXECUTE video_pkg.return_movie(111, 1, 'RENTED')
```

anonymous block completed

Put this movie on hold -- reserved by member #107

anonymous block completed

Error starting at line 3 in command:

```
EXECUTE video_pkg.return_movie(111, 1, 'RENTED')
```

Error report:

ORA-20999: Unhandled error in RETURN\_MOVIE. Please contact your application administrator with the following information:

ORA-01403: no data found

ORA-06512: at "ORA61.VIDEO\_PKG", line 12

ORA-06512: at "ORA61.VIDEO\_PKG", line 69

ORA-06512: at line 1

## Part B: Additional Practice 5 Solutions

5. The business hours for the video store are 8:00 AM through 10:00 PM, Sunday through Friday, and 8:00 AM through 12:00 AM on Saturday. To ensure that the tables can be modified only during these hours, create a stored procedure that is called by triggers on the tables.
  - a. Create a stored procedure called `TIME_CHECK` that checks the current time against business hours. If the current time is not within business hours, use the `RAISE_APPLICATION_ERROR` procedure to give an appropriate message.

```
CREATE OR REPLACE PROCEDURE time_check IS
BEGIN
  IF ((TO_CHAR(SYSDATE, 'D') BETWEEN 1 AND 6) AND
      (TO_DATE(TO_CHAR(SYSDATE, 'hh24:mi'), 'hh24:mi') NOT BETWEEN
        TO_DATE('08:00', 'hh24:mi') AND TO_DATE('22:00', 'hh24:mi')))
    OR ((TO_CHAR(SYSDATE, 'D') = 7)
        AND (TO_DATE(TO_CHAR(SYSDATE, 'hh24:mi'), 'hh24:mi') NOT BETWEEN
          TO_DATE('08:00', 'hh24:mi') AND TO_DATE('24:00', 'hh24:mi'))) THEN
    RAISE_APPLICATION_ERROR(-20999,
      'Data changes restricted to office hours.');
```

```
  END IF;
END time_check;
/
SHOW ERRORS

PROCEDURE time_check Compiled.
No Errors.
```

- b. Create a trigger on each of the five tables. Fire the trigger before data is inserted, updated, and deleted from the tables. Call your `TIME_CHECK` procedure from each of these triggers.

```
CREATE OR REPLACE TRIGGER member_trig
  BEFORE INSERT OR UPDATE OR DELETE ON member
CALL time_check
/

CREATE OR REPLACE TRIGGER rental_trig
  BEFORE INSERT OR UPDATE OR DELETE ON rental
CALL time_check
/

CREATE OR REPLACE TRIGGER title_copy_trig
  BEFORE INSERT OR UPDATE OR DELETE ON title_copy
CALL time_check
/

CREATE OR REPLACE TRIGGER title_trig
  BEFORE INSERT OR UPDATE OR DELETE ON title
CALL time_check
/
```

## Part B: Additional Practice 5 Solutions (continued)

```
CREATE OR REPLACE TRIGGER reservation_trig
  BEFORE INSERT OR UPDATE OR DELETE ON reservation
CALL time_check
/
```

```
TRIGGER member_trig Compiled.
TRIGGER rental_trig Compiled.
TRIGGER title_copy_trig Compiled.
TRIGGER title_trig Compiled.
TRIGGER reservation_trig Compiled.
```

c. Test your triggers.

**Note:** In order for your trigger to fail, you may need to change the time to be outside the range of your current time in class. For example, while testing, you may want valid video hours in your trigger to be from 6:00 PM through 8:00 AM.

```
-- First determine current timezone and time
SELECT SESSIONTIMEZONE,
       TO_CHAR(CURRENT_DATE, 'DD-MON-YYYY HH24:MI') CURR_DATE
FROM DUAL;
```

SESSIONTIMEZONE	CURR_DATE
+00:00	11-JUN-2007 16:51

```
-- Change your time zone usinge [+|-]HH:MI format such that the current
-- time returns a time between 6pm and 8am
ALTER SESSION SET TIME_ZONE='-07:00';
```

```
ALTER SESSION SET succeeded.
```

## Part B: Additional Practice 5 Solutions (continued)

```
-- Add a new member (for a sample test)
EXECUTE video_pkg.new_member('Elias', 'Elliane', 'Vine Street',
'California', '789-123-4567')

BEGIN video_pkg.new_member('Elias', 'Elliane', 'Vine Street',
'California', '789-123-4567'); END;

*

ERROR at line 1:
ORA-20999: Unhandled error in NEW_MEMBER. Please contact your application
administrator with the following information: ORA-20999: Data changes
restricted to office hours.
ORA-06512: at "ORA1.TIME_CHECK", line 9
ORA-06512: at "ORA1.MEMBER_TRIG", line 1
ORA-04088: error during execution of trigger 'ORA1.MEMBER_TRIG'
ORA-06512: at "ORA1.VIDEO_PKG", line 12
ORA-06512: at "ORA1.VIDEO_PKG", line 171
ORA-06512: at line 1

-- Restore the original time zone for your session.
ALTER SESSION SET TIME_ZONE='-00:00';

Session altered.
```



---

# **Additional Practices: Table Descriptions and Data**

---

## Part A

The tables and data used in part A are the same as those in Appendix B, “Table Descriptions.”

## Part B: Tables Used

TNAME	TABTYPE	CLUSTERID
MEMBER	TABLE	
RENTAL	TABLE	
RESERVATION	TABLE	
TITLE	TABLE	
TITLE_COPY	TABLE	

## Part B: MEMBER Table

DESCRIBE member

Name	Null?	Type
MEMBER_ID	NOT NULL	NUMBER(10)
LAST_NAME	NOT NULL	VARCHAR2(25)
FIRST_NAME		VARCHAR2(25)
ADDRESS		VARCHAR2(100)
CITY		VARCHAR2(30)
PHONE		VARCHAR2(25)
JOIN_DATE	NOT NULL	DATE

SELECT \* FROM member;

MEMBER_ID	LAST_NAME	FIRST_NAME	ADDRESS	CITY	PHONE	JOIN_DATE
101	Velasquez	Carmen	283 King Street	Seattle	587-99-6666	03-MAR-90
102	Ngao	LaDoris	5 Modrany	Bratislava	586-355-8882	08-MAR-90
103	Nagayama	Midori	68 Via Centrale	Sao Paolo	254-852-5764	17-JUN-91
104	Quick-To-See	Mark	6921 King Way	Lagos	63-559-777	07-APR-90
105	Ropeburn	Audry	86 Chu Street	Hong Kong	41-559-87	04-MAR-90
106	Urguhart	Molly	3035 Laurier Blvd.	Quebec	418-542-9988	18-JAN-91
107	Menchu	Roberta	Boulevard de Waterloo 41	Brussels	322-504-2228	14-MAY-90
108	Biri	Ben	398 High St.	Columbus	614-455-9863	07-APR-90
109	Catchpole	Antoinette	88 Alfred St.	Brisbane	616-399-1411	09-FEB-92

9 rows selected.

## Part B: RENTAL Table

DESCRIBE rental

Name	Null?	Type
BOOK_DATE	NOT NULL	DATE
COPY_ID	NOT NULL	NUMBER(10)
MEMBER_ID	NOT NULL	NUMBER(10)
TITLE_ID	NOT NULL	NUMBER(10)
ACT_RET_DATE		DATE
EXP_RET_DATE		DATE

SELECT \* FROM rental;

BOOK_DATE	COPY_ID	MEMBER_ID	TITLE_ID	ACT_RET_D	EXP_RET_D
02-OCT-01	2	101	93		04-OCT-01
01-OCT-01	3	102	95		03-OCT-01
30-SEP-01	1	101	98		02-OCT-01
29-SEP-01	1	106	97	01-OCT-01	01-OCT-01
30-SEP-01	1	101	92	01-OCT-01	02-OCT-01

## Part B: RESERVATION Table

DESCRIBE reservation

Name	Null?	Type
RES_DATE	NOT NULL	DATE
MEMBER_ID	NOT NULL	NUMBER(10)
TITLE_ID	NOT NULL	NUMBER(10)

SELECT \* FROM reservation;

RES_DATE	MEMBER_ID	TITLE_ID
02-OCT-01	101	93
01-OCT-01	106	102

## Part B: TITLE Table

DESCRIBE title

Name	Null?	Type
TITLE_ID	NOT NULL	NUMBER(10)
TITLE	NOT NULL	VARCHAR2(60)
DESCRIPTION	NOT NULL	VARCHAR2(400)
RATING		VARCHAR2(4)
CATEGORY		VARCHAR2(20)
RELEASE_DATE		DATE

SELECT \* FROM title;

TITLE_ID	TITLE	DESCRIPTION	RATI	CATEGORY	RELEASE_D
92	Willie and Christmas Too	All of Willie's friends made a Christmas list for Santa, but Willie has yet to create his own wish list.	G	CHILD	05-OCT-95
93	Alien Again	Another installment of science fiction history. Can the heroine save the planet from the alien life form?	R	SCIFI	19-MAY-95
94	The Glob	A meteor crashes near a small American town and unleashes carivorous goo in this classic.	NR	SCIFI	12-AUG-95
95	My Day Off	With a little luck and a lot of ingenuity, a teenager skips school for a day in New York.	PG	COMEDY	12-JUL-95
96	Miracles on Ice	A six-year-old has doubts about Santa Claus. But she discovers that miracles really do exist.	PG	DRAMA	12-SEP-95
97	Soda Gang	After discovering a cached of drugs, a young couple find themselves pitted against a vicious gang.	NR	ACTION	01-JUN-95
98	Interstellar Wars	Futuristic interstellar action movie. Can the rebels save the humans from the evil Empire?	PG	SCIFI	07-JUL-77

7 rows selected.

## Part B: TITLE\_COPY Table

DESCRIBE title\_copy

Name	Null?	Type
COPY_ID	NOT NULL	NUMBER(10)
TITLE_ID	NOT NULL	NUMBER(10)
STATUS	NOT NULL	VARCHAR2(15)

SELECT \* FROM title\_copy;

COPY_ID	TITLE_ID	STATUS
1	92	AVAILABLE
1	93	AVAILABLE
2	93	RENTED
1	94	AVAILABLE
1	95	AVAILABLE
2	95	AVAILABLE
3	95	RENTED
1	96	AVAILABLE
1	97	AVAILABLE
1	98	RENTED
2	98	AVAILABLE

11 rows selected.