



Oracle AI Database: PL/SQL Fundamentals

Student Guide - Volume I
D1112615GC10

Copyright © 2026, Oracle and/or its affiliates.

Disclaimer

This document contains proprietary information and is protected by copyright and other intellectual property laws. 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 and is not warranted to be error-free. If you find any errors, please report them to us in writing.

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 END USERS: Oracle programs (including any operating system, integrated software, any programs embedded, installed or activated on delivered hardware, and modifications of such programs) and Oracle computer documentation or other Oracle data delivered to or accessed by U.S. Government end users are "commercial computer software" or "commercial computer software documentation" pursuant to the applicable Federal Acquisition Regulation and agency-specific supplemental regulations. As such, the use, reproduction, duplication, release, display, disclosure, modification, preparation of derivative works, and/or adaptation of i) Oracle programs (including any operating system, integrated software, any programs embedded, installed or activated on delivered hardware, and modifications of such programs), ii) Oracle computer documentation and/or iii) other Oracle data, is subject to the rights and limitations specified in the license contained in the applicable contract. The terms governing the U.S. Government's use of Oracle cloud services are defined by the applicable contract for such services. No other rights are granted to the U.S. Government.

Trademark Notice

Oracle®, Java, MySQL, and NetSuite are registered trademarks of Oracle and/or its affiliates. Other names may be trademarks of their respective owners.

Intel and Intel Inside are trademarks or registered trademarks of Intel Corporation. All SPARC trademarks are used under license and are trademarks or registered trademarks of SPARC International, Inc. AMD, Epyc, and the AMD logo are trademarks or registered trademarks of Advanced Micro Devices. UNIX is a registered trademark of The Open Group.

Third-Party Content, Products, and Services Disclaimer

This documentation may provide access to or information about content, products, and services from third parties. Oracle Corporation and its affiliates are not responsible for and expressly disclaim all warranties of any kind with respect to third-party content, products, and services unless otherwise set forth in an applicable agreement between you and Oracle. Oracle Corporation and its affiliates will not be responsible for any loss, costs, or damages incurred due to your access to or use of third-party content, products, or services, except as set forth in an applicable agreement between you and Oracle.

1003272026

Contents

1 Introduction

- Objectives 1-2
- Lesson Agenda 1-3
- Course Objectives 1-4
- Course Road Map 1-5
- Lesson Agenda 1-11
- Human Resources (HR) Schema for This Course 1-12
- Agenda 1-13
- Class Account Information 1-16
- Appendixes and Practices Used in This Course 1-17
- Lesson Agenda 1-18
- Oracle Database 23ai: Focus Areas 1-19
- Oracle Database 23ai 1-20
- Lesson Agenda 1-22
- PL/SQL Development Environments 1-23
- SQL Developer for VSCode 1-24
- Oracle SQL Developer 1-25
- Specifications of SQL Developer 1-26
- SQL Developer Interface 1-27
- Coding PL/SQL in SQL*Plus 1-28
- Lesson Agenda 1-34
- Oracle SQL and PL/SQL Documentation 1-35
- Additional Resources 1-36
- Summary 1-37
- Introduction Practice Overview: Getting Started 1-38

2 Introduction to PL/SQL

- Course Road Map 2-2
- Objectives 2-3
- Agenda 2-4
- Limitations of SQL 2-5
- Why PL/SQL? 2-6
- About PL/SQL 2-8
- Benefits of PL/SQL 2-9
- PL/SQL Runtime Architecture 2-11

PL/SQL Block Structure 2-12
Agenda 2-13
Block Types 2-14
Examining an Anonymous Block 2-16
Executing an Anonymous Block 2-17
Agenda 2-18
Enabling Output of a PL/SQL Block 2-19
Viewing the Output of a PL/SQL Block 2-20
Summary 2-22

3 Declaring PL/SQL Variables

Course Road Map 3-2
Objectives 3-3
Agenda 3-4
Variables 3-5
Variables in PL/SQL 3-6
Requirements for Variable Names 3-8
Using Variables in PL/SQL 3-9
Declaring and Initializing PL/SQL Variables 3-10
Agenda 3-11
Declaring and Initializing PL/SQL Variables 3-12
Initializing Variables Through a SELECT Statement 3-13
Types of Variables 3-15
Declaring Variables 3-16
Guidelines for Declaring and Initializing PL/SQL Variables 3-17
Guidelines for Declaring PL/SQL Variables 3-18
Naming Conventions of the PL/SQL Structures Used in This Course 3-19
Data Types for Strings 3-20
Delimiters in String Literals 3-21
Data Types for Numeric values 3-22
Data Types for Date and Time values 3-23
Data Type Conversion 3-25
Agenda 3-27
The %TYPE Attribute 3-28
Declaring Variables with the %TYPE Attribute 3-29
Declaring Boolean Variables 3-30
LOB Data Type Variables 3-31
Composite Data Types: Records and Collections 3-32
Agenda 3-33
Bind Variables 3-34
Bind Variables: Examples 3-35

Using AUTOPRINT with Bind Variables 3-36
Summary 3-37

4 Writing Executable Statements

Course Road Map 4-2
Objectives 4-3
Agenda 4-4
Lexical Units in a PL/SQL Block 4-5
PL/SQL Block Syntax and Guidelines 4-7
Commenting Code 4-8
SQL Functions in PL/SQL 4-9
SQL Functions in PL/SQL: Examples 4-10
Using Sequences in PL/SQL Blocks 4-11
Agenda 4-15
Nested Blocks 4-16
Nested Blocks: Example 4-17
Variable Scope and Visibility 4-18
Using a Qualifier with Nested Blocks 4-20
Challenge: Determining the Variable Scope 4-21
Agenda 4-23
Operators in PL/SQL 4-24
Operators in PL/SQL: Examples 4-25
Programming Guidelines 4-26
Indenting Code 4-27
Summary 4-28

5 Using SQL Statements Within a PL/SQL Block

Course Road Map 5-2
Objectives 5-3
Agenda 5-4
SQL Statements in PL/SQL 5-5
SELECT Statements in PL/SQL 5-7
Retrieving Data in PL/SQL: Example 5-9
Retrieving Data in PL/SQL 5-10
Naming Ambiguities 5-11
Avoiding Naming Ambiguities 5-12
Agenda 5-13
Using PL/SQL to Manipulate Data 5-14
Insert Data: Example 5-15
Update Data: Example 5-16
Delete Data: Example 5-17

Merging Rows 5-18
Agenda 5-20
SQL Cursor 5-21
SQL Cursor Attributes for Implicit Cursors 5-23
Summary 5-25

6 Writing Control Structures

Course Road Map 6-2
Objectives 6-3
PL/SQL Control Structures 6-4
Agenda 6-5
IF Statement 6-6
IF-ELSIF Statements 6-7
Simple IF Statement 6-8
IF THEN ELSE Statement 6-9
IF ELSIF ELSE Clause 6-10
NULL Value in an IF Statement 6-11
Agenda 6-12
CASE Expressions 6-13
Searched CASE Expressions 6-14
CASE Statement 6-16
Handling Nulls 6-17
Logic Tables 6-18
Boolean Expression or Logical Expression? 6-19
Agenda 6-20
Iterative Control: LOOP Statements 6-21
Basic Loops 6-22
Basic Loop: Example 6-23
WHILE Loops 6-24
WHILE Loops: Example 6-25
FOR Loops 6-26
FOR Loops: Example 6-28
FOR Loop Rules 6-29
Suggested Use of Loops 6-30
Nested Loops and Labels 6-31
Nested Loops and Labels: Example 6-32
PL/SQL CONTINUE Statement 6-33
PL/SQL CONTINUE Statement: Example 1 6-34
PL/SQL CONTINUE Statement: Example 2 6-35
Summary 6-36

7 Working with Composite Data Types

- Course Road Map 7-2
- Objectives 7-3
- Agenda 7-4
- Composite Data Types 7-5
- PL/SQL Records Versus Collections 7-7
- Agenda 7-8
- PL/SQL Records 7-9
- Creating a PL/SQL Record 7-10
- Creating a PL/SQL Record: Example 7-11
- PL/SQL Record Structure 7-12
- %ROWTYPE Attribute 7-14
- Creating a PL/SQL Record: Example 7-16
- Advantages of Using the %ROWTYPE Attribute 7-17
- Another %ROWTYPE Attribute: Example 7-18
- Inserting a Record by Using %ROWTYPE 7-19
- Updating a Row in a Table by Using a Record 7-20
- Agenda 7-21
- Associative Arrays (INDEX BY Tables) 7-22
- Associative Array Structure 7-24
- Steps to Create an Associative Array 7-25
- Creating and Accessing Associative Arrays 7-26
- Associative Arrays with Record Values 7-27
- Using Collection Methods 7-28
- Using Collection Methods with Associative Arrays 7-29
- Nested Tables 7-30
- Nested Tables: Syntax and Usage 7-31
- Variable-Sized Arrays (Varrays) 7-32
- VARRAYs: Syntax and Usage 7-33
- Summarizing Collections 7-34
- Summary 7-35

8 Using Explicit Cursors

- Course Road Map 8-2
- Objectives 8-3
- Agenda 8-4
- Cursors 8-5
- Implicit Cursors 8-6
- Explicit Cursor 8-7
- Controlling Explicit Cursors 8-8
- Agenda 8-9

Declaring the Cursor 8-10
Opening the Cursor 8-11
Fetching Data from the Cursor 8-12
Closing the Cursor 8-14
Cursors and Records 8-15
Cursor FOR Loops 8-16
Explicit Cursor Attributes 8-18
%ISOPEN Attribute 8-19
%ROWCOUNT and %NOTFOUND: Example 8-20
Cursor FOR Loops Using Subqueries 8-21
Agenda 8-22
Cursors with Parameters 8-23
Agenda 8-25
FOR UPDATE Clause 8-26
WHERE CURRENT OF Clause 8-28
WHERE CURRENT OF Clause: Example 8-29
Summary 8-31

9 Handling Exceptions

Course Road Map 9-2
Objectives 9-3
Agenda 9-4
What is an exception? 9-5
Handling an Exception: Example 9-6
Understanding Exceptions with PL/SQL 9-7
Handling Exceptions 9-8
Exception Types 9-9
Agenda 9-10
Syntax to Trap Exceptions 9-11
Guidelines for Trapping Exceptions 9-13
Trapping Internally Predefined Exceptions 9-14
Internally Defined Exception Trapping: Example 9-15
Trapping Predefined Exceptions 9-16
Functions for Trapping Exceptions 9-19
Trapping User-Defined Exceptions 9-21
RAISE Statement 9-22
Trapping User-Defined Exceptions 9-23
Propagating Exceptions in a Sub-Block 9-24
The RAISE_APPLICATION_ERROR Procedure 9-25
Summary 9-28

10 Introducing Stored Procedures and Functions

Course Road Map 10-2

Objectives 10-3

Agenda 10-4

What are PL/SQL Subprograms? 10-5

Differences Between Anonymous Blocks and Subprograms 10-7

Agenda 10-8

Procedure: Syntax 10-9

Creating a Procedure 10-10

Invoking a Procedure 10-12

Agenda 10-13

Function: Syntax 10-14

Creating a Function 10-15

Invoking a Function 10-16

Passing a Parameter to the Function 10-17

Invoking the Function with a Parameter 10-18

Summary 10-19

11 Creating Procedures

Course Road Map 11-2

Objectives 11-3

Agenda 11-4

Modularized Program Design 11-5

Modularizing Code with PL/SQL 11-6

Benefits of Modularization 11-7

What are PL/SQL Subprograms? 11-8

Agenda 11-9

Procedures 11-10

What are Procedures? 11-11

Creating Procedures: Overview 11-12

Creating Procedures 11-13

Compiling Procedures 11-16

Calling Procedures 11-17

Calling Procedures Using SQL Developer for VS Code 11-19

Procedures 11-20

What are Parameters and Parameter Modes? 11-21

Formal and Actual Parameters 11-22

Procedural Parameter Modes 11-23

Comparing the Parameter Modes 11-24

Using the IN Parameter Mode: Example 11-25

Using the OUT Parameter Mode: Example 11-26

Using the IN OUT Parameter Mode: Example 11-27
Passing Parameters to Procedures 11-28
Passing Actual Parameters: Creating the raise_sal Procedure 11-29
Passing Actual Parameters: Examples 11-30
Using the DEFAULT Option for the Parameters 11-31
Agenda 11-32
Handled Exceptions 11-33
Handled Exceptions: Example 11-34
Exceptions Not Handled 11-35
Exceptions Not Handled: Example 11-36
Removing Procedures: Using the DROP SQL Statement or SQL Developer 11-37
Viewing Procedure Information Using the Data Dictionary Views 11-38
Viewing Procedure Information Using SQL Developer 11-39
Summary 11-40

12 Creating Functions

Course Road Map 12-2
Objectives 12-3
Agenda 12-4
Functions 12-5
Creating Functions syntax 12-6
Tax Calculation 12-8
The Difference Between Procedures and Functions 12-9
Creating Functions: Overview 12-10
Invoking a Stored Function: Example 12-11
Using Different Methods for Executing Functions 12-12
Agenda 12-15
Using a Function in a SQL Expression: Example 12-16
Calling User-Defined Functions in SQL Statements 12-17
Restrictions When Calling Functions from SQL Expressions 12-18
Side Effects of Function Execution 12-19
Controlling Side Effects 12-20
Guidelines to Control Side Effects 12-21
Agenda 12-22
Passing Parameters to Functions 12-23
Named and Mixed Notation from SQL: Example 12-24
Viewing Functions Using Data Dictionary Views 12-25
Viewing Function Information Using SQL Developer for VS Code 12-26
Agenda 12-27
Removing Functions: Using the DROP SQL Statement or SQL Developer 12-28
Summary 12-29

13 Debugging Subprograms

- Course Road Map 13-2
- Objectives 13-3
- Agenda 13-4
- Prerequisites for Debugging PL/SQL Subprograms 13-5
- Agenda 13-9
- Debugging a Subprogram: Overview 13-10
- Agenda 13-12
- Debugging: Log Tab Toolbar 13-13
- Tracking Data and Execution 13-15
- Agenda 13-16
- Debugging a Procedure: Example 13-17
- Setting Breakpoints and Compiling emp_list for Debug Mode 13-19
- Compiling the get_location Function for Debug Mode 13-20
- Debugging emp_list and Entering Values for the PMAXROWS Parameter 13-21
- Debugging emp_list: Step Into the Code (F7) 13-22
- Viewing the Data 13-23
- Modifying the Variables While Debugging the Code 13-24
- Debugging emp_list: Step Over Versus Step Into 13-25
- Debugging emp_list: Step Out of the Code (Shift + F7) 13-26
- Debugging emp_list: Step to End of Method 13-27
- Debugging a Subprogram Remotely 13-28
- Summary 13-29
- Practice 13 Overview: Introduction to the SQL Developer Debugger 13-30

14 Creating Packages

- Course Road Map 14-2
- Objectives 14-3
- Agenda 14-4
- DBMS_OUTPUT.PUT_LINE 14-5
- What Is a Package? 14-6
- Advantages of Packages 14-7
- How Do You Create PL/SQL Packages? 14-8
- Components of a PL/SQL Package 14-9
- Application Program Interface 14-10
- Agenda 14-11
- Creating the Package Specification: Using the
CREATE PACKAGE Statement 14-12
- Example of a Package Specification: comm_pkg 14-15
- Creating the Package Body 14-16
- Example of a Package Body: comm_pkg 14-17

Invoking the Package Subprograms: Examples	14-18
Invoking Package Subprograms: Using SQL Developer for VS Code	14-19
Creating and Using Bodiless Packages	14-20
Viewing Packages by Using the Data Dictionary	14-21
Viewing Packages by Using SQL Developer for VS Code	14-22
Removing Packages	14-23
Removing Package Bodies	14-24
Guidelines for Writing Packages	14-25
Summary	14-26

15 Working with Packages

Course Road Map	15-2
Objectives	15-3
Agenda	15-4
Why Overload Subprograms?	15-5
Overloading Subprograms in PL/SQL	15-6
Overloading Procedures Example: Creating the Package Specification	15-8
Overloading Procedures Example: Creating the Package Body	15-9
Restrictions on Overloading	15-10
STANDARD Package	15-11
Overloading and the STANDARD Package	15-12
Agenda	15-13
Package Instantiation and Initialization	15-14
Initializing Packages in the Package Body	15-15
Using User-Defined Package Functions in SQL	15-16
User-Defined Package Function in SQL: Example	15-17
Agenda	15-18
Package State	15-19
Serially Reusable Packages	15-20
Memory Architecture	15-21
Serially Reusable Packages	15-23
Persistent State of Packages	15-24
Persistent State of Package Variables: Example	15-25
Persistent State of a Package Cursor: Example	15-26
Executing the CURS_PKG Package	15-28
Summary	15-29

16 Using Oracle-Supplied Packages in Application Development

Course Road Map	16-2
Objectives	16-3
Agenda	16-4

- Using Oracle-Supplied Packages 16-5
- Oracle-Supplied Packages: Examples 16-6
- Agenda 16-7
- How the DBMS_OUTPUT Package Works 16-8
- Using the UTL_FILE Package 16-9
- UTL_FILE Procedures and Functions 16-11
- File Processing Using the UTL_FILE Package 16-12
- Using the Available Declared Exceptions in the UTL_FILE Package 16-13
- FOPEN and IS_OPEN Functions: Example 16-14
- Using UTL_FILE: Example 16-17
- What Is the UTL_MAIL Package? 16-19
- Setting Up and Using UTL_MAIL 16-20
- UTL_MAIL Subprograms: Summary 16-21
- Installing and Using UTL_MAIL 16-22
- SEND Procedure Syntax 16-23
- SEND_ATTACH_RAW Procedure 16-24
- Sending Email with a Binary Attachment: Example 16-25
- SEND_ATTACH_VARCHAR2 Procedure 16-27
- Sending Email with a Text Attachment: Example 16-28
- Summary 16-33

17 Using Dynamic SQL

- Course Road Map 17-2
- Objectives 17-3
- Agenda 17-4
- What is Dynamic SQL? 17-5
- When do you use Dynamic SQL? 17-6
- Using Dynamic SQL 17-7
- Execution Flow of SQL Statements 17-8
- Dynamic SQL Implementation 17-9
- Agenda 17-10
- Native Dynamic SQL (NDS) 17-11
- Using the EXECUTE IMMEDIATE Statement 17-12
- Dynamic SQL with a DDL Statement: Examples 17-13
- Dynamic SQL with DML Statements 17-14
- Dynamic SQL with a Single-Row Query: Example 17-15
- Executing a PL/SQL Anonymous Block Dynamically 17-16
- BULK COLLECT INTO Clause 17-17
- OPEN FOR Clause 17-18
- Using BULK COLLECT and OPEN FOR Clause 17-19
- Summarizing Methods for Using Dynamic SQL 17-20

Agenda 17-22
DBMS_SQL Package: Overview 17-23
Using the DBMS_SQL Package 17-25
Using the DBMS_SQL Package Subprograms 17-26
Using DBMS_SQL with a DML Statement: Deleting Rows 17-27
Using DBMS_SQL with a Parameterized DML Statement 17-28
Summary 17-29

18 Creating Triggers

Course Road Map 18-2
Objectives 18-3
Agenda 18-4
What are triggers? 18-6
Defining Triggers 18-7
Why use triggers? 18-8
Trigger Event Types 18-9
Available Trigger Types 18-10
Trigger Event Types and Body 18-11
Agenda 18-12
Creating DML Triggers by Using the CREATE TRIGGER Statement 18-13
Specifying the Trigger Execution Time 18-15
Creating a DML Statement Trigger: Example – SECURE_EMP 18-16
Testing the SECURE_EMP Trigger 18-17
Using Conditional Predicates 18-18
Multiple Triggers of the Same Type 18-19
CALL Statements in Triggers 18-20
Agenda 18-21
Statement-Level Triggers Versus Row-Level Triggers 18-22
Creating a DML Row Trigger 18-24
Correlation Names and Pseudorecords 18-25
Using OLD and NEW Qualifiers 18-27
Using OLD and NEW Qualifiers: Example 18-28
Using the WHEN Clause to Fire a Row Trigger Based on a Condition 18-30
Trigger-Firing Sequence: Single-Row Manipulation 18-31
Trigger-Firing Sequence: Multirow Manipulation 18-32
Trigger Execution Model: Summary 18-33
Agenda 18-34
INSTEAD OF Triggers 18-35
Creating an INSTEAD OF Trigger: Example 18-36
Creating an INSTEAD OF Trigger to Perform DML on Complex Views 18-37
Agenda 18-39

- Status of a Trigger 18-40
- System Privileges Required to Manage Triggers 18-41
- Managing Triggers by Using the ALTER and DROP SQL Statements 18-42
- Managing Triggers by Using SQL Developer 18-43
- Viewing Trigger Information 18-44
- Using USER_TRIGGERS 18-45
- Testing Triggers 18-46
- Summary 18-47

19 Creating Compound, DDL, and Event Database Triggers

- Course Road Map 19-2
- Objectives 19-3
- Agenda 19-4
- What is a compound trigger? 19-5
- Working with Compound Triggers 19-6
- Why use compound triggers? 19-7
- Compound Trigger Structure 19-8
- Compound Trigger Structure for Views 19-9
- Compound Trigger Restrictions 19-10
- Agenda 19-11
- Mutating Tables 19-12
- Mutating Table: Example 19-13
- Compound Trigger to Resolve the Mutating Table Error 19-15
- Agenda 19-18
- Creating Triggers on DDL Statements 19-19
- Creating Triggers on DDL Statements: Example 19-20
- Agenda 19-21
- Creating Database Triggers 19-22
- Creating Triggers on System Events 19-23
- LOGON and LOGOFF Triggers: Example 19-24
- Agenda 19-25
- Guidelines for Designing Triggers 19-26
- Summary 19-27

20 Design Considerations for the PL/SQL Code

- Course Road Map 20-2
- Objectives 20-3
- Agenda 20-4
- Standardizing Constants and Exceptions 20-5
- Standardizing Exceptions 20-6
- Standardizing Exception Handling 20-7

Standardizing Constants	20-8
Local Subprograms	20-9
Agenda	20-10
Definer's and Invoker's Rights	20-11
Specifying Invoker's Rights: Setting AUTHID to CURRENT_USER	20-12
Granting Privileges to Invoker's Rights Unit	20-13
Agenda	20-14
Autonomous Transactions	20-15
Autonomous Transactions: Features	20-16
Using Autonomous Transactions: Example	20-17
Agenda	20-19
Using the NOCOPY Hint	20-20
Effects of the NOCOPY Hint	20-21
When Does the PL/SQL Compiler Ignore the NOCOPY Hint?	20-22
Using the PARALLEL_ENABLE Hint	20-23
Using the Cross-Session PL/SQL Function Result Cache	20-24
Declaring and Defining a Result-Cached Function: Example	20-25
Using the DETERMINISTIC Clause with Functions	20-26
Using the RETURNING Clause	20-27
Agenda	20-28
Using Bulk Binding	20-29
Bulk Binding: Syntax and Keywords	20-30
Bulk Binding FORALL: Example	20-31
Using BULK COLLECT INTO with Queries	20-34
Using BULK COLLECT INTO with Cursors	20-35
Using BULK COLLECT INTO with a RETURNING Clause	20-36
Summary	20-37

21 Tuning the PL/SQL Compiler

Course Road Map	21-2
Objectives	21-3
Agenda	21-4
Optimizing PL/SQL Compiler Performance	21-5
Initialization Parameters for PL/SQL Compilation	21-6
Using the Initialization Parameters for PL/SQL Compilation	21-8
Displaying the PL/SQL Initialization Parameters	21-9
Displaying and Setting PL/SQL Initialization Parameters	21-10
Changing PL/SQL Initialization Parameters: Example	21-11
Agenda	21-12
PL/SQL Compile-Time Warnings	21-13
Compiler Warnings: Benefits	21-14

- Categories of PL/SQL Compile-Time Warning Messages 21-15
- Enabling Warning Messages 21-16
- Setting Compiler Warning Levels: Using PLSQL_WARNINGS – Examples 21-17
- Viewing the Current Setting of PLSQL_WARNINGS 21-19
- Viewing Compiler Warnings 21-20
- SQL*Plus Warning Messages: Example 21-21
- Defining PLSQL_WARNINGS for Program Units 21-22
- Agenda 21-23
- Using the DBMS_WARNINGS Package 21-24
- Using the DBMS_WARNING Package Subprograms 21-25
- DBMS_WARNING Procedures: Syntax, Parameters, and Allowed Values 21-26
- DBMS_WARNING Procedures: Example 21-27
- DBMS_WARNING Functions: Syntax, Parameters, and Allowed Values 21-28
- DBMS_WARNING Functions: Example 21-29
- Using DBMS_WARNING: Example 21-30
- Summary 21-32

22 Managing Dependencies

- Course Road Map 22-2
- Objectives 22-3
- Agenda 22-4
- What are dependencies in a schema? 22-5
- How Dependencies Work 22-6
- Dependent and Referenced Objects 22-8
- Querying Object Dependencies: Using the USER_DEPENDENCIES View 22-10
- Querying an Object's Status 22-11
- Categorizing Dependencies 22-12
- Agenda 22-13
- Direct Dependencies 22-14
- Indirect Dependencies 22-15
- Displaying Direct and Indirect Dependencies 22-16
- Agenda 22-18
- Fine-Grained Dependency Management 22-19
- Fine-Grained Dependency Management: Example 1 22-21
- Fine-Grained Dependency Management: Example 2 22-23
- Guidelines for Reducing Invalidation 22-24
- Object Revalidation 22-25
- Agenda 22-26
- Remote Dependencies 22-27
- Managing Remote Procedure Dependencies 22-28
- Setting the REMOTE_DEPENDENCIES_MODE Parameter 22-29

Timestamp Checking 22-30
Signature Checking 22-35
Agenda 22-36
Revalidating PL/SQL Program Units 22-37
Unsuccessful Recompilation 22-38
Successful Recompilation 22-39
Recompiling Procedures 22-40
Agenda 22-41
Packages and Dependencies: Subprogram References the Package 22-42
Packages and Dependencies: Package Subprogram References Procedure 22-43
Summary 22-44

A Using SQL Developer

Objectives A-2
What is Oracle SQL Developer? A-3
Specifications of SQL Developer A-4
SQL Developer Interface A-5
Creating a Database Connection A-7
Browsing Database Objects A-10
Displaying the Table Structure A-11
Browsing Files A-12
Creating a Schema Object A-13
Creating a New Table: Example A-14
Using the SQL Worksheet A-15
Executing SQL Statements A-18
Saving SQL Scripts A-19
Executing Saved Script Files: Method 1 A-20
Executing Saved Script Files: Method 2 A-21
Formatting the SQL Code A-22
Using Snippets A-23
Using Snippets: Example A-24
Debugging Procedures and Functions A-25
Database Reporting A-26
Creating a User-Defined Report A-27
Search Engines and External Tools A-28
Setting Preferences A-29
Resetting the SQL Developer Layout A-31
Data Modeler in SQL Developer A-32
Summary A-33

B Using SQL*Plus

- Objectives B-2
- SQL and SQL*Plus Interaction B-3
- SQL Statements Versus SQL*Plus Commands B-4
- Overview of SQL*Plus B-5
- Logging In to SQL*Plus B-6
- Displaying the Table Structure B-7
- SQL*Plus Editing Commands B-9
- Using LIST, n, and APPEND B-11
- Using the CHANGE Command B-12
- SQL*Plus File Commands B-13
- Using the SAVE, START Commands B-14
- SERVEROUTPUT Command B-15
- Using the SQL*Plus SPOOL Command B-16
- Using the AUTOTRACE Command B-17
- Summary B-18

C Commonly Used SQL Commands

- Objectives C-2
- Basic SELECT Statement C-3
- SELECT Statement C-4
- WHERE Clause C-5
- ORDER BY Clause C-6
- GROUP BY Clause C-7
- Data Definition Language C-8
- CREATE TABLE Statement C-9
- ALTER TABLE Statement C-10
- DROP TABLE Statement C-11
- GRANT Statement C-12
- Privilege Types C-13
- REVOKE Statement C-14
- TRUNCATE TABLE Statement C-15
- Data Manipulation Language C-16
- INSERT Statement C-17
- UPDATE Statement Syntax C-18
- DELETE Statement C-19
- Transaction Control Statements C-20
- COMMIT Statement C-21
- ROLLBACK Statement C-22
- SAVEPOINT Statement C-23
- Joins C-24

- Types of Joins C-25
- Qualifying Ambiguous Column Names C-26
- Natural Join C-27
- Equijoins C-28
- Retrieving Records with Equijoins C-29
- Additional Search Conditions Using the AND and WHERE Operators C-30
- Retrieving Records with Nonequijoins C-31
- Retrieving Records by Using the USING Clause C-32
- Retrieving Records by Using the ON Clause C-33
- Left Outer Join C-34
- Right Outer Join C-35
- Full Outer Join C-36
- Self-Join: Example C-37
- Cross Join C-38
- Summary C-39

D REF Cursors

- Cursor Variables D-2
- Using Cursor Variables D-3
- Defining REF CURSOR Types D-4
- Using the OPEN-FOR, FETCH, and CLOSE Statements D-7
- Fetching: Example D-10

E Managing PL/SQL Code

- Objectives E-2
- Agenda E-3
- Conditional Compilation E-4
- How Does Conditional Compilation Work? E-5
- Using Selection Directives E-6
- Using Predefined and User-Defined Inquiry Directives E-7
- PLSQL_CCFLAGS Parameter and the Inquiry Directive E-8
- Displaying the PLSQL_CCFLAGS Initialization Parameter Setting E-9
- PLSQL_CCFLAGS Parameter and the Inquiry Directive: Example E-10
- Using Conditional Compilation Error Directives to Raise User-Defined Errors E-11
- Using Static Expressions with Conditional Compilation E-12
- DBMS_DB_VERSION Package: Boolean Constants E-13
- DBMS_DB_VERSION Package Constants E-14
- Using Conditional Compilation with Database Versions: Example E-15
- Using DBMS_PREPROCESSOR Procedures to Print or Retrieve Source Text E-17
- Agenda E-18
- Obfuscation E-19

Obfuscating: Benefits E-20
What's new in dynamic obfuscating since Oracle 10g? E-21
Nonobfuscated PL/SQL Code: Example E-22
Obfuscated PL/SQL Code: Example E-23
Dynamic Obfuscation: Example E-24
PL/SQL Wrapper Utility E-25
Running the PL/SQL Wrapper Utility E-26
Results of Wrapping E-27
Guidelines for Wrapping E-28
DBMS_DDL Package Versus wrap Utility E-29
Summary E-30

F 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

G Using the DBMS_SCHEDULER

Objectives G-2
Generating Webpages 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