

# Contents

## I Introduction

- Lesson Objectives I-2
- Course Objectives I-3
- Human Resources (HR) Schema for This Course I-4
- Course Agenda I-5
- Class Account Information I-6
- Appendixes Used in This Course I-7
- PL/SQL Development Environments I-8
- What Is Oracle SQL Developer? I-9
- Coding PL/SQL in SQL\*Plus I-10
- Coding PL/SQL in Oracle JDeveloper I-11
- Starting SQL Developer and Creating a Database Connection I-12
- Creating Schema Objects I-13
- Using the SQL Worksheet I-14
- Executing SQL Statements I-16
- Saving SQL Scripts I-17
- Executing Saved Script Files: Method 1 I-18
- Executing Saved SQL Scripts: Method 2 I-19
- Oracle 11g SQL and PL/SQL Documentation I-20
- Summary I-21
- Practice I Overview: Getting Started I-22

## 1 Introduction to PL/SQL

- Objectives 1-2
- About PL/SQL 1-3
- PL/SQL Environment 1-5
- Benefits of PL/SQL 1-6
- PL/SQL Block Structure 1-9
- Block Types 1-11
- Program Constructs 1-13
- Create an Anonymous Block 1-15
- Execute an Anonymous Block 1-16
- Test the Output of a PL/SQL Block 1-17
- Quiz 1-19

Summary 1-20  
Practice 1: Overview 1-21

## **2 Declaring PL/SQL Variables**

Objectives 2-2  
Use of Variables 2-3  
Requirements for Variable Names 2-4  
Handling Variables in PL/SQL 2-5  
Declaring and Initializing PL/SQL Variables 2-6  
Delimiters in String Literals 2-8  
Types of Variables 2-9  
Guidelines for Declaring and Initializing PL/SQL Variables 2-11  
Guidelines for Declaring PL/SQL Variables 2-12  
Scalar Data Types 2-13  
Base Scalar Data Types 2-14  
Declaring Scalar Variables 2-18  
%TYPE Attribute 2-19  
Declaring Variables with the %TYPE Attribute 2-21  
Declaring Boolean Variables 2-22  
Bind Variables 2-23  
Printing Bind Variables 2-25  
LOB Data Type Variables 2-27  
Composite Data Types 2-28  
Quiz 2-29  
Summary 2-30  
Practice 2: Overview 2-31

## **3 Writing Executable Statements**

Objectives 3-2  
Lexical Units in a PL/SQL Block 3-3  
PL/SQL Block Syntax and Guidelines 3-5  
Commenting Code 3-6  
SQL Functions in PL/SQL 3-7  
SQL Functions in PL/SQL: Examples 3-8  
Using Sequences in PL/SQL Expressions 3-9  
Data Type Conversion 3-10  
Nested Blocks 3-13  
Nested Blocks: Example 3-14  
Variable Scope and Visibility 3-15

Qualify an Identifier	3-17
Determining Variable Scope: Example	3-18
Operators in PL/SQL	3-20
Operators in PL/SQL: Examples	3-21
Programming Guidelines	3-22
Indenting Code	3-23
Quiz	3-24
Summary	3-25
Practice 3: Overview	3-26
<b>4 Interacting with the Oracle Database Server</b>	
Objectives	4-2
SQL Statements in PL/SQL	4-3
SELECT Statements in PL/SQL	4-4
Retrieving Data in PL/SQL: Example	4-8
Retrieving Data in PL/SQL	4-9
Naming Conventions	4-10
Using PL/SQL to Manipulate Data	4-12
Inserting Data: Example	4-13
Updating Data: Example	4-14
Deleting Data: Example	4-15
Merging Rows	4-16
SQL Cursor	4-18
SQL Cursor Attributes for Implicit Cursors	4-20
Quiz	4-22
Summary	4-23
Practice 4: Overview	4-24
<b>5 Writing Control Structures</b>	
Objectives	5-2
Controlling Flow of Execution	5-3
IF Statement	5-4
Simple IF Statement	5-6
IF THEN ELSE Statement	5-7
IF ELSIF ELSE Clause	5-8
NULL Value in IF Statement	5-9
CASE Expressions	5-10
CASE Expressions: Example	5-11
Searched CASE Expressions	5-12
CASE Statement	5-13

- Handling Nulls 5-14
- Logic Tables 5-15
- Boolean Conditions 5-16
- Iterative Control: LOOP Statements 5-17
- Basic Loops 5-18
  - WHILE Loops 5-20
  - WHILE Loops: Example 5-21
  - FOR Loops 5-22
  - FOR Loops: Example 5-24
  - FOR Loops 5-25
  - Guidelines for Loops 5-26
  - Nested Loops and Labels 5-27
  - PL/SQL CONTINUE Statement 5-29
  - PL/SQL CONTINUE Statement: Example 5-30
  - Quiz 5-32
  - Summary 5-33
  - Practice 5: Overview 5-34

## **6 Working with Composite Data Types**

- Objectives 6-2
- Composite Data Types 6-3
- PL/SQL Records 6-5
  - %ROWTYPE Attribute 6-6
  - Advantages of Using the %ROWTYPE Attribute 6-8
  - Creating a PL/SQL Record 6-9
  - Creating a PL/SQL Record: Example 6-10
  - PL/SQL Record Structure 6-11
  - %ROWTYPE Attribute: Example 6-12
  - Inserting a Record by Using %ROWTYPE 6-13
  - Updating a Row in a Table by Using a Record 6-14
- INDEX BY Tables or Associative Arrays 6-15
  - Creating an INDEX BY Table 6-16
  - INDEX BY Table Structure 6-18
  - Creating an INDEX BY Table 6-19
  - Using INDEX BY Table Methods 6-20
  - INDEX BY Table of Records 6-21
  - INDEX BY Table of Records: Example 6-23
- Nested Tables 6-24
- VARRAY 6-26

Quiz 6-27  
Summary 6-28  
Practice 6: Overview 6-29

## **7 Using Explicit Cursors**

Objectives 7-2  
Cursors 7-3  
Explicit Cursor Operations 7-4  
Controlling Explicit Cursors 7-5  
Declaring the Cursor 7-7  
Opening the Cursor 7-9  
Fetching Data from the Cursor 7-10  
Closing the Cursor 7-13  
Cursors and Records 7-14  
Cursor FOR Loops 7-15  
Explicit Cursor Attributes 7-17  
%ISOPEN Attribute 7-18  
%ROWCOUNT and %NOTFOUND: Example 7-19  
Cursor FOR Loops Using Subqueries 7-20  
Cursors with Parameters 7-21  
FOR UPDATE Clause 7-23  
WHERE CURRENT OF Clause 7-25  
Cursors with Subqueries: Example 7-26  
Quiz 7-27  
Summary 7-28  
Practice 7: Overview 7-29

## **8 Handling Exceptions**

Objectives 8-2  
Example of an Exception 8-3  
Handling Exceptions with PL/SQL 8-5  
Handling Exceptions 8-6  
Exception Types 8-7  
Trapping Exceptions 8-8  
Guidelines for Trapping Exceptions 8-10  
Trapping Predefined Oracle Server Errors 8-11  
Trapping Non-Predefined Oracle Server Errors 8-14  
Non-Predefined Error 8-15  
Functions for Trapping Exceptions 8-16  
Trapping User-Defined Exceptions 8-18

Propagating Exceptions in a Subblock 8-20  
RAISE\_APPLICATION\_ERROR Procedure 8-21  
Quiz 8-24  
Summary 8-25  
Practice 8: Overview 8-26

## **9 Creating Stored Procedures and Functions**

Objectives 9-2  
Procedures and Functions 9-3  
Differences Between Anonymous Blocks and Subprograms 9-4  
Procedure: Syntax 9-5  
Procedure: Example 9-6  
Invoking the Procedure 9-8  
Function: Syntax 9-9  
Function: Example 9-10  
Invoking the Function 9-11  
Passing a Parameter to the Function 9-12  
Invoking the Function with a Parameter 9-13  
Quiz 9-14  
Summary 9-15  
Practice 9: Overview 9-16

## **Appendix A: Practice Solutions**

## **Appendix B: Table Descriptions and Data**

## **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: Using SQL\*Plus**

Objectives	D-2
SQL and SQL*Plus Interaction	D-3
SQL Statements Versus SQL*Plus Commands	D-4
Overview of SQL*Plus	D-5
Logging In to SQL*Plus	D-6
Changing the Settings of SQL*Plus Environment	D-7
Displaying Table Structure	D-8
SQL*Plus Editing Commands	D-10
Using LIST, n, and APPEND	D-12
Using the CHANGE Command	D-13
SQL*Plus File Commands	D-14
Using the SAVE, START, and EDIT Commands	D-15
SERVEROUTPUT Command	D-17
Using the SQL*Plus SPOOL Command	D-18
Using the AUTOTRACE Command	D-19
Summary	D-20

## **Appendix E: Using JDeveloper**

Oracle JDeveloper	E-2
Connection Navigator	E-3
Applications - Navigator	E-4
Structure Window	E-5
Editor Window	E-6
Deploying Java Stored Procedures	E-7

Publishing Java to PL/SQL E-8  
Creating Program Units E-9  
Compiling E-10  
Running a Program Unit E-11  
Dropping a Program Unit E-12  
Debugging PL/SQL Programs E-13  
Setting Breakpoints E-16  
Stepping Through Code E-17  
Examining and Modifying Variables E-18

## **Appendix F: REF Cursors**

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

## **Additional Practices**

## **Additional Practice Solutions**

## **Index**