Introduction to Oracle Programming

A Relational Database Management System (RDBMS) is a software system that allows you to create and manage a relational database. Minimum requirements for such a system are defined by both ANSI and ISO. The Structured Query Language (SQL) is the international standard language for relational database management systems. SQL is robust enough to be used by, users with non-technical backgrounds, as well as professional developers and administrators. PL/SQL is Oracle’s Procedural Language for SQL. It is Oracle’s database programming language for creating stored procedures, functions, database triggers, and object methods. PL/SQL can be used for implementing business rules, computing algorithms, manipulating data, and for stand-alone programs.

This course is a combination of “Introduction to Oracle SQL Programming” and “Introduction to Oracle PL/SQL Programming.” Students will learn how to create, retrieve, and manipulate objects in Oracle Database 10*g* Structured Query Language (SQL). Students will also be introduced to Oracle10*g* features and tools. Students will learn the fundamentals of the PL/SQL programming language, writing stored procedures, functions, packages, and triggers.

Course Objectives:

- Describe the features of a Relational Database and interact with a Relational Database Management System.
- Use SQL*Plus to connect to an Oracle database and submit SQL statements.
- Write SQL queries and functions, including joining together data items from multiple tables.
- Write nested queries.
- Perform summary analysis of data in a query.
- Add, change, and remove data in a database.
- Work in a multi-user database environment.
- Create and manage tables and other database objects.
- Control access to data.
- Create indexes to improve query performance.
- Use SQL*Plus to create formatted reports.
- Create triggers on database tables.
- Use PL/SQL's datatypes and collection datatypes for database and program data.
- Use program structure and control flow to design and write PL/SQL programs.
- Create PL/SQL stored procedures and functions.
- Write robust programs that handle runtime exceptions.
- Use cursors to work with database data.
- Use the packages supplied with Oracle, as well as design and write your own packages.
- Manage the security of your stored PL/SQL programs.

Audience: Application developers, database administrators, system administrators, and users who write applications and procedures that access Oracle 10*g*.

Prerequisites: A solid understanding of 3GL programming is required.

Number of Days: 5 days

1. **Course Introduction**
    - Course Objectives
    - Overview
    - Suggested References
2. **Relational Database and SQL Overview**
    - Review of Relational Database Terminology
    - Relational Database Management Systems
    - Introduction to SQL
    - Oracle Versioning and History
    - Logical and Physical Storage Structures
    - Connecting to a SQL Database
    - Datatypes
    - Sample Database
3. **Using Oracle SQL*Plus**
    - SQL*Plus
    - The SQL Buffer
    - Buffer Manipulation Commands
    - Running SQL*Plus Scripts
    - Tailoring Your SQL*Plus Environment
    - Viewing Table Characteristics
    - SQL*Plus Substitution Variables
    - Interactive SQL*Plus Scripts
    - SQL*Plus LOB Support
    - Using iSQL*Plus
    - Graphical Clients
4. **SQL Queries - The SELECT Statement**
    - The SELECT Statement
    - The CASE...WHEN Statement
    - Choosing Rows with the WHERE Clause
    - NULL Values
    - Compound Expressions
    - IN and BETWEEN
    - Pattern Matching: LIKE and REGEXP_LIKE
    - Creating Some Order
5. **Scalar Functions**
    - SQL Functions
    - Using SQL Functions
    - String Functions
    - Numeric Functions
    - Date Functions
    - Date Formats
    - Conversion Functions
    - Literal Values
    - Intervals
    - Oracle Pseudocolumns
6. **SQL Queries - Joins**
    - Selecting from Multiple Tables
    - Joining Tables
    - Self Joins
    - Outer Joins
7. **Aggregate Functions and Advanced Techniques**
    - Subqueries
    - Correlated Subqueries
    - The EXISTS Operator
    - The Aggregate Functions
    - Nulls and DISTINCT
    - Grouping Rows
    - Combining SELECT Statements
8. **Data Manipulation and Transactions**
    - The INSERT Statement
    - The UPDATE Statement
    - The DELETE Statement
    - Transaction Management
    - Concurrency
    - Explicit Locking
    - Data Inconsistencies
    - Loading Tables From External Sources
9. **Data Definition and Control Statements**
    - Datatypes
    - Defining Tables
    - Constraints
    - Inline Constraints
    - Modifying Table Definitions
    - Deleting a Table Definition
    - Controlling Access to Your Tables
10. **Other Database Objects**
    - Views
    - Creating Views
    - Updatable Views

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Sequences
Synonyms
11. Triggers
Beyond Declarative Integrity
Triggers
Types of Triggers
Row-Level Triggers
Trigger Predicates
Trigger Conditions
Using SEQUENCEs
Cascading Triggers and Mutating Tables
Generating an Error
Maintaining Triggers
12. PL/SQL Variables and Datatypes
Anonymous Blocks
Declaring Variables
Datatypes
Subtypes
Character Data
Dates and Timestamps
Date Intervals
Anchored Types
Assignment and Conversions
Selecting into a Variable
Returning into a Variable
13. PL/SQL Syntax and Logic
Conditional Statements – IF/THEN
Conditional Statements – CASE
Comments and Labels
Loops
WHILE and FOR Loops
SQL in PL/SQL
Local Procedures and Functions
14. Stored Procedures and Functions
Stored Subprograms
Creating a Stored Procedure
Procedure Calls and Parameters
Parameter Modes
Creating a Stored Function
Stored Functions and SQL
Invoker's Rights
15. Exception Handling
SQLCODE and SQLERRM
Exception Handlers
Nesting Blocks
Scope and Name Resolution
Declaring and Raising Named Exceptions
User-Defined Exceptions
16. Records, Collections, and User-Defined Types
Record Variables
Using the %ROWTYPE Attribute
VARRAY and Nested TABLE Collections
Using Nested TABLEs
Using VARRAYs
Collection in Database Tables
Associative Array Collections
Collection Methods
Iterating Through Collections
17. Cursors
Multi-Row Queries
Declaring and Opening Cursors
Fetching Rows
Closing Cursors
The Cursor FOR Loop
FOR UPDATE Cursors
Cursor Parameters
The Implicit (SQL) Cursor
18. Bulk Operations
Bulk Binding
BULK COLLECT Clause
FORALL Statement
FORALL Variations
Bulk Returns
Bulk Fetching with Cursors
19. Using Packages
Packages
Oracle-Supplied Packages
The DBMS_OUTPUT Package
The DBMS_UTILITY Package
The UTL_FILE Package
Creating Pipes with DBMS_PIPE
Writing to and Reading from a Pipe
The DBMS_METADATA Package
XML Packages
Networking Packages

Other Supplied Packages

20. Creating Packages

Structure of a Package
The Package Interface and Implementation
Package Variables and Package State
Overloading Package Functions and Procedures
Forward Declarations
Strong REF CURSOR Variables
Weak REF CURSOR Variables

21. Working with LOBs

Large Object Types
Oracle Directories
LOB Locators
Internal LOBs
External LOBs
Temporary LOBs
The DBMS_LOB Package

22. Maintaining PL/SQL Code

Privileges for Stored Programs
Data Dictionary
PL/SQL Stored Program Compilation
Conditional Compilation
Compile-Time Warnings
The PL/SQL Execution Environment
Dependencies and Validation
Maintaining Stored Programs

23. Appendix A – The Data Dictionary

Introducing the Data Dictionary
DBA, ALL, and USER Data Dictionary Views
Some Useful Data Dictionary Queries

24. Appendix B – Dynamic SQL

Generating SQL at Runtime
Native Dynamic SQL vs. DBMS_SQL Package
The EXECUTE IMMEDIATE Statement
Using Bind Variables
Multi-row Dynamic Queries
Bulk Operations with Dynamic SQL
Using DBMS_SQL
DBMS_SQL Subprograms

25. Appendix C – PL/SQL Versions, Datatypes, and Language Limits

26. Appendix D – Oracle 10*g* Supplied Packages