

## Oracle Database 12c: New Features for Administrators (40 hrs.)

**Prerequisites:** Oracle Database 11g: Administration Workshop I

### Course Topics:

#### Introduction

- Overview
- Oracle Database Innovation
- Enterprise Cloud Computing
- Oracle Database 12c New and Enhanced Features

#### Enterprise Manager Cloud Control and Other Tools

- Oracle Database 12c New and Enhanced Features
- Objectives
- Key Challenges for Administrators
- Enterprise Manager Cloud Control
- Cloud Control Components
- Components and Communication Flow
- Oracle Management Repository
- Controlling the Enterprise Manager Cloud Control Framework
- Starting the Enterprise Manager Cloud Control Framework
- Stopping the Enterprise Manager Cloud Control Framework
- Different Target Types
- Target Discovery
- Enterprise Manager Cloud Control
- User Interface
- Security: Overview
- Managing Securely with Credentials
- Distinguishing Credentials
- EM Database Express Architecture -
- Configuring Enterprise Manager Database Express
- Home Page
- Menus
- Database Configuration Assistant
- Oracle SQL Developer: Connections
- Oracle SQL Developer: DBA Actions

#### Basics of Multitenant Container Database and Pluggable Databases

- Module: Multitenant Container Database and Pluggable Databases
- Oracle Database 12c New and Enhanced Features
- Objectives
- Challenges
- Oracle Database in 11g Release
- New Multitenant Architecture: Benefits
- Other Benefits of Multitenant Architecture
- Configurations
- Multitenant Container Database
- Pristine Installation
- Adding User Data
- Separating SYSTEM and User Data
- SYSTEM Objects in the USER Container

- Naming the Containers
- Provisioning a Pluggable Database
- Interacting Within Multitenant Container Database
- Multitenant Container Database Architecture
- Containers
- Questions: Root Versus PDBs
- Questions: PDBs Versus Root
- Terminology
- Common and Local Users
- Common and Local Privileges and Roles
- Shared and Non-Shared Objects
- Data Dictionary Views
- Impacts

### **Creating Multitenant Container Databases and Pluggable Databases**

- Oracle Database 12c New and Enhanced Features
- Objectives
- Goals
- Tools
- Steps to Create a Multitenant Container Database
- Creating a Multitenant Container Database: Using SQL\*Plus
- Creating a Multitenant Container Database: Using DBCA
- New Clause: SEED FILE\_NAME\_CONVERT
- New Clause: ENABLE PLUGGABLE DATABASE
- After CDB Creation: What's New in CDB
- Data Dictionary Views: DBA\_XXX
- Data Dictionary Views: CDB\_XXX
- Data Dictionary Views: Examples
- Data Dictionary Views: V\$XXX Views
- After CDB Creation: To-Do List
- Automatic Diagnostic Repository
- Automatic Diagnostic Repository: alert.log File
- Practice 3 Overview: Creating a CDB and PDBs
- Provisioning New Pluggable Databases
- Tools
- Method 1: Create New PDB from PDB\$SEED
- Steps: With FILE\_NAME\_CONVERT
- Steps: Without FILE\_NAME\_CONVERT
- Method 1: Using SQL Developer
- Synchronization
- Method 2: Plug a Non-CDB into CDB
- Plug a Non-CDB into CDB Using DBMS\_PDB
- Method 3: Clone PDBs
- Method 4: Plug Unplugged PDB into CDB
- Method 4: Flow
- Plug Sample Schemas PDB: Using DBCA
- Dropping a PDB
- Migrating pre-12.1 Databases to 12.1 CDB

### **Managing Multitenant Container Databases and Pluggable Databases**

- Oracle Database 12c New and Enhanced Features
- Objectives

- Connection
- Connection with SQL\*Developer
- Switching Connections
- Starting Up a CDB Instance
- Mounting a CDB
- Opening a CDB
- Opening a PDB
- Closing a PDB
- Shutting Down a CDB Instance
- Database Event Triggers: Automatic PDB Opening
- Changing PDB Mode
- Changing PDB Mode: With SQL Developer
- Modifying PDB Settings
- Instance Parameter Change Impact
- Instance Parameter Change Impact: Example

## **Managing Tablespaces and Users in CDB and PDBs**

- Oracle Database 12c New and Enhanced Features
- Objectives
- Tablespaces in PDBs
- Creating Permanent Tablespaces in a CDB
- Assigning Default Tablespaces
- Creating Local Temporary Tablespaces
- Assigning Default Temporary Tablespaces
- Users, Roles, and Privileges
- Local Users, Roles, and Privileges
- Creating a Local User
- Common Users
- Creating a Common User
- Common and Local Schemas / Users
- Common and Local Privileges
- Granting and Revoking Privileges
- Creating Common and Local Roles
- Granting Common or Local Privileges / Roles to Roles
- Granting Common and Local Roles to Users
- Granting and Revoking Roles
- Creating Shared and Non-Shared Objects
- Restriction on Definer's Rights

## **Backup, Recovery, and Flashback CDBs and PDBs**

- Oracle Database 12c New and Enhanced Features
- Objectives
- Goals
- New Syntax and Clauses in RMAN
- CDB Backup: Whole CDB Backup
- CDB Backup: User-Managed Hot CDB Backup
- CDB Backup: Partial CDB Backup
- PDB Backup: Whole PDB Backup
- PDB Backup: Partial PDB Backup
- Recovery
- Instance Failure
- NOARCHIVELOG Mode
- Media Failure: CDB or PDB Temp File Recovery

- Media Failure: PDB Temp File Recovery
- Media Failure: Control File Loss
- Media Failure: Redo Log File Loss
- Media Failure: Root SYSTEM or UNDO Data File
- Media Failure: Root SYSAUX Data File
- Media Failure: PDB SYSTEM Data File
- Media Failure: PDB Non-SYSTEM Data File
- Media Failure: PITR
- Flashback CDB
- Special Situations
- Data Dictionary Views: RC\_PDBS

#### **Heat Map, Automatic Data Optimization And Online Data File and Partition Move**

- Automatic Data Optimization and Storage Enhancements
- Oracle Database 12c New and Enhanced Features
- Objectives
- ILM Challenges and Solutions
- ILM Components
- ILM Challenges
- Solutions
- Components
- What Is Automatic Data Optimization?
- Data Classification Levels
- Heat Map and ADO
- Enabling Heat Map
- Monitoring Statistics: Segment-Level
- DBA\_HEAT\_MAP\_SEGMENT View
- Monitoring Statistics: Block Level
- Monitoring Statistics: Extent Level
- Defining Automatic Detection Conditions
- Defining Automatic Actions -
- Compression Levels and Types -
- Creating Compression Policies Tablespace and Group
- Creating Compression Policies Segment and Row
- Creating Storage Tiering Policy
- Storage Tiering: Priority
- Storage Tiering: READ ONLY
- Policy Relying on Function
- Multiple SEGMENT Policies on a Segment
- Only One Single ROW Policy on a Segment
- Policy Inheritance
- Displaying Policies
- DBA\_ILMPOLICIES/DBA\_ILMDATAMOVEMENTPOLICIES
- Displaying Policies DBA\_ILMDATAMOVEMENTPOLICIES
- Preparing Evaluation and Execution
- Customizing Evaluation and Execution
- Monitoring Evaluation and Execution
- ADO DDL
- Turning ADO Off and On
- Stop Activity Tracking and Clean Up Heat Map Statistics
- Specific Situations of Activity Tracking
- Online Move Data File

- Compression
- REUSE and KEEP
- States
- Compatibilities
- Flashback Database
- Online Move Partition
- Online Move Partition: Benefits
- Online Move Partition: Compress

#### **In-Database Archiving and Temporal**

- Oracle Database 12c New and Enhanced Features
- Objectives
- Archiving Challenges
- Archiving Solutions
- In-Database Archiving: HCC
- Archiving Challenges and Solutions
- In-Database Archiving
- ORA\_ARCHIVE\_STATE column
- Session Visibility Control
- Disable Row-Archival
- PERIOD FOR Clause Concept
- Filtering on Valid-Time Columns: Example
- Filtering on Valid-Time Columns: Example
- DBMS\_FLASHBACK\_ARCHIVE
- Temporal History Enhancements: FDA Optimization
- Temporal History Enhancements: User Context Metadata -

#### **Auditing**

- Module - Security
- Oracle Database 12c New and Enhanced Features
- Objectives
- Types of Auditing
- Audit Trail Implementation
- Oracle Database 12c Auditing
- Security and Performance: Audit Architecture
- Tolerance Level for Loss of Audit Records
- Consolidation: Unique Audit Trail
- Basic Audit Versus Extended Audit Information
- Extended Audit Information
- Data Pump Audit Policy
- Oracle RMAN Audit Information
- Unified Audit Implementation
- Security: Roles
- Security: SYS Auditing
- Simplicity: Audit Policy
- Step 1: Creating the Audit Policy
- Creating the Audit Policy: Object-Specific Actions
- Creating the Audit Policy: Condition
- Step 2: Enabling / Disabling the Audit Policy
- Viewing the Audit Policy
- Using Predefined Audit Policies
- Including Application Context Data
- Dropping the Audit Policy

- Audit Cleanup

### Privileges

- Oracle Database 12c New and Enhanced Features
- Objectives
- Major Challenges
- Administrative Privileges
- New Administrative Privileges
- New Administrative Privilege: SYSBACKUP
- New Administrative Privilege: SYSDG
- New Administrative Privilege: SYSKM
- OS Authentication and OS Groups
- Password Authentication for SYSBACKUP
- Password Authentication for SYSDG
- Oracle Database Vault Data Protection and Administration Privileged Users
- Privileged Administrators' Auditing
- New System Privilege: PURGE DBA\_RECYCLEBIN
- Privilege Analysis
- Privilege Analysis Flow
- Creating Policies: Database and Role Analysis
- Creating Policies: Context Analysis
- Creating Policies: Combined Analysis Types
- Analyzing and Reporting
- SYSTEM and OBJECT Used Privileges
- Used Privileges Results
- Compare Used and Unused Privileges
- Views
- Dropping an Analysis
- Privilege Checking During PL/SQL Calls
- New Privilege Checking During PL/SQL Calls
- INHERIT (ANY) PRIVILEGES Privileges
- Privilege Checking with New BEQUEATH Views

### Oracle Data Redaction

- Oracle Database 12c New and Enhanced Features
- Objectives
- Oracle Data Redaction: Overview
- Oracle Data Redaction and Operational Activities
- Available Redaction Methods
- Oracle Data Redaction: Examples
- What Is a Redaction Policy?
- Managing Redaction Policies
- Defining a Redaction Policy
- Adding a Redaction Policy to a Table or View
- Full Redaction: Examples
- Partial Redaction: Examples
- Regular Expression
- Modifying the Redaction Policy
- Exempting Users from Redaction Policies
- Defining Data Redaction Policies by Using Cloud Control c
- Creating a Data Redaction Policy
- Using Oracle Data Redaction with Other Oracle Database Security Solutions
- Oracle Database Security Features

- Best Practices: Preventing Unauthorized Policy Modifications and Exemptions
- Best Practices: Considerations

## **Recovery Manager New Features**

- Module – High Availability
- Oracle Database 12c New and Enhanced Features
- Objectives
- Separation of DBA Duties
- Using SQL in RMAN
- Backing Up and Restoring Very Large Files
- RMAN Duplication Enhancements
- Duplicating an Active Database
- What Is New?
- The NOOPEN Option
- Duplicating Pluggable Databases
- Recovering Databases with Third-Party Snapshots
- Transporting Data Across Platforms
- Data Transport
- Transporting Database: Process Steps -1
- Transporting Database: Process Steps -2
- Transporting Tablespace: Process Steps -1
- Transporting Tablespace: Process Steps -2
- Table Recovery -
- Recovering Tables from Backups
- Table Recovery: Graphical Overview
- Specifying the Recovery Point-in-Time
- Process Steps of Table Recovery
- Customization

## **Real-Time Database Operation Monitoring**

- Module – Manageability
- Oracle Database 12c New and Enhanced Features
- Objectives
- Overview
- Use Cases
- Current Tools
- Defining a DB Operation
- Scope of a Composite DB Operation
- Database Operation Concepts
- Identifying a Database Operation
- Enabling Monitoring of Database Operations
- Identifying, Starting, and Completing a Database Operation
- Monitoring the Progress of a Database Operation
- Monitoring Load Database Operations
- Monitoring Load Database Operation Details
- Reporting Database Operations Using Views
- Reporting Database Operations Using Functions
- Database Operation Tuning

## **Schema and Data Change Management**

- Oracle Database 12c New and Enhanced Features
- Objectives
- Database Lifecycle Management Pack New Features
- Change Management Pack Features

- Change Management Pack Components
- Dictionary Baselines
- Dictionary Comparisons
- Dictionary Synchronization
- Comparing Change Propagation and g SQL Scripts
- Database Lifecycle Management Pack Schema Change Plans
- Change Requests
- Schema Synchronization
- Database Lifecycle Management Pack Data Comparisons
- DBMS\_COMPARISON
- Flow
- Guidelines
- Creating a Data Comparison
- Comparison Job and Results
- Results: Reference Only Rows
- Results: Candidate-Only Rows
- Results: Non-Identical Rows

## SQL Tuning Enhancements

- Module – Performance
- Oracle Database 12c New and Enhanced Features
- Objectives
- Road Map
- SQL Plan Baseline: Architecture
- SQL Plan Management: Overview
- Adaptive SQL Plan Management
- Automatically Evolving SQL Plan Baseline
- SQL Management Base Enhancements
- Lesson Road Map
- Adaptive Execution Plans
- Dynamic Plans
- Dynamic Plan: Adaptive Process
- Dynamic Plans: Example
- Reoptimization: Cardinality Feedback
- Cardinality Feedback: Monitoring Query Executions
- Cardinality Feedback: Reparsing Statements
- Automatic Re-optimization
- Lesson Road Map
- SQL Plan Directives
- Using SQL Plan Directives
- SQL Plan Directives: Example
- Online Statistics Gathering for Bulk-Load
- Concurrent Statistics Enhancements in Oracle Database 12c
- Statistics for Global Temporary Tables
- Histogram Enhancements
- Top Frequency Histograms
- Hybrid Histograms
- Hybrid Histograms: Example
- Extended Statistics Enhancements
- Capturing Column Group Usage
- Capturing Column Group Usage: Running the Workload
- Creating Column Groups Detected During Workload Monitoring



- Automatic Dynamic Sampling
- Enhancements

### **Emergency Monitoring, Real-Time ADDM, Compare Period ADDM, and ASH Analytics**

- Oracle Database 12c New and Enhanced Features
- Objectives
- Emergency Monitoring: Challenges
- Emergency Monitoring: Goals
- Real-Time ADDM: Challenges
- Real-Time ADDM: Goals
- Flow
- Using the DBMS\_ADDM Package
- AWR Compare Periods Report
- Tool: Preserved Snapshot Sets
- Preserved Snapshot Sets
- AWR Comparison with AWR Snapshot Sets
- AWR Compare Periods: Examples
- AWR Comparison with DB Replay
- What is Missing?
- Analysis
- Workload Compatibility
- Comparison Modes
- Report: Configuration
- Report: Finding
- Report: Resource CPU and I/O
- Report: Resource Memory
- Using the DBMS\_ADDM Package
- ASH: Overview
- Top Activity Page
- ASH Analytics Page: Activity

### **Resource Manager and Other Performance Enhancements**

- Oracle Database 12c New and Enhanced Features
- Objectives
- Resource Manager and Pluggable Databases
- Managing Resources Between PDBs
- CDB Resource Plan Basics: Share
- CDB Resource Plan Basics: Limits
- CDB Resource Plan: Full Example
- Creating a CDB Resource Plan
- Creating CDB Resource Plan: SQL Example
- Viewing CDB Resource Plan Directives
- Enabling a CDB Resource Plan
- Maintaining a CDB Resource Plan
- Managing Resources Within a PDB
- Managing PDB Resource Plans
- Putting It Together
- Considerations
- Runaway Queries and Resource Manager
- Default UNIX/Linux Architecture
- Multi-Process Multi-Threaded UNIX/Linux Architecture
- Multi-Process Multi-Threaded Architecture: Benefits
- Multi-Process Multi-Threaded Architecture Setup

- Multi-Process Multi-Threaded Architecture Considerations
- Multi-Process Multi-Threaded Architecture Monitoring
- Database Smart Flash Cache Enhancements
- Enabling and Disabling Flash Devices
- In-Memory PQ Algorithm: Benefits
- Smart Flash Cache: New Statistics
- Temporary Undo: Overview
- Temporary Undo: Benefits
- Temporary Undo Setup
- Temporary Undo Monitoring
- Resources

#### **Tables, Indexes, and Online Operations Enhancements**

- Oracle Database 12c New and Enhanced Features
- Objectives
- Why Multiple Indexes on the Same Set of Columns?
- Creating Multiple Indexes on the Same Set of Columns
- Invisible and Hidden Columns in SQL\*Plus
- SET COLINVISIBLE and DESCRIBE Commands
- Online Redefinition: Tables with VPD
- Online Redefinition: dml\_lock\_timeout
- Advanced Row Compression – New Feature Name and Syntax –
- LOB Compression: New Name
- Using the Compression Advisor
- Enhanced Online DDL Capabilities
- DROP INDEX / CONSTRAINT
- Index UNUSABLE
- SET UNUSED Column

#### **ADR and Network Enhancements**

- Oracle Database 12c New and Enhanced Features
- Objectives
- Automatic Diagnostic Repository
- ADR File Types
- ADR Files: DDL and DEBUG Log Files
- ADR Files: Location
- New ADRCI Command
- Network Performance: Compression
- Setting Up Compression
- SDU Size
- Setting SDU Size

#### **Oracle Data Pump, SQL\*Loader, and External Tables**

- Module – Miscellaneous
- Oracle Database 12c New and Enhanced Features
- Objectives
- Full Transportable Export/Import: Overview
- Full Transportable Export/Import: Usage
- Full Transportable Export/Import: Example
- Transporting a Database Over the Network: Example
- Disabling Logging for Oracle Data Pump Import: Overview
- Disabling Logging for Oracle Data Pump Import: Usage
- Disabling Logging for Oracle Data Pump Import: Command-Line Examples
- Exporting Views as Tables: Overview

- Exporting Views as Tables: Usage
- Exporting Views as Tables: Command-Line Examples
- Specifying the Encryption Password
- Compressing Tables During Import
- Creating SecureFile LOBs During Import
- SQL\*Loader Support for Direct-Path Loading of Identity Columns
- SQL\*Loader and External Table Enhancements
- SQL\*Loader Express Mode

### Partitioning Enhancements

- Oracle Database 12c New and Enhanced Features
- Objectives
- Online Partition Operations
- Online Partition Operations: Benefits
- Online Partition Operation: Compression
- Enhancements to Reference Partitioning
- Interval Reference Partitioning
- TRUNCATE TABLE CASCADE
- Multi-Partition Maintenance Operations
- Adding Multiple Partitions
- Creating a Range-Partitioned Table
- Adding Multiple Partitions
- Truncating Multiple Partitions
- Dropping Multiple Partitions
- Splitting into Multiple Partitions
- Splitting into Multiple Partitions: Examples
- Splitting into Multiple Partitions Rules
- Splitting into Multiple Partitions: Examples
- Merging Multiple Range Partitions
- Merging List and System Partitions
- Partitioned Indexes: Review
- Partial Indexes for Partitioned Tables
- Partial Index Creation on a Table
- Specifying the INDEXING Clause at the Partition and Subpartition Levels
- Creating a Partial Local or Global Index
- Explain Plan: LOCAL INDEX ROWID
- Explain Plan: GLOBAL INDEX ROWID
- Affected Data Dictionary Views Overview
- Asynchronous Global Index Maintenance
- The DBMS\_PART Package
- Global Index Maintenance Optimization During Partition Maintenance Operations
- Forcing an Index Cleanup: Additional Methods

### SQL Enhancements and Migration Assistant for Unicode

- Oracle Database 12c New and Enhanced Features
- Objectives
- Increased Length Limits of Data Types
- Configuring Database for Extended Data Type
- Using VARCHAR, NVARCHAR, and RAW Data Types
- Database Migration Assistant for Unicode
- SecureFiles
- SQL Row-Limiting Clause
- SQL Row-Limiting Clause: Examples

#### New and Enhanced Features in Other Courses

- Further Information
- Suggested Oracle University ILT Courses
- nplugged PDB: Using SQL Developer B