

## SQL Server 2012 Optimization, Performance Tuning and Troubleshooting

### Course Summary

#### Description

During this five-day intensive course, students will learn the internal architecture of SQL Server and the typical environments it operate in. This will enable them to better diagnose problems and improve the performance of their SQL Server environments. Students will also dive through the various bottlenecks of SQL Server, learn how to optimize them, and troubleshoot common problems.

#### Objectives

At the end of this course, students will be able to:

- Configure database physical storage and filegroups
- Manage database compression
- Troubleshoot common virtualization problems
- Troubleshoot and optimize locking and concurrency issues
- Optimize and maintain statistics
- Read, understand and troubleshoot complex execution plans
- Detect and optimize common poorly performing coding practices
- Optimize data loading
- Maintain databases for optimal performance

#### Topics

- SQL Server Architecture
- SQL Server CPU
- Introduction of SQL Server Memory Architecture
- SQL Server Files and Filegroups
- Introduction to Disk Subsystem Terminology and Architecture
- Physical Architecture of Databases and Storage Internals
- Transaction Log and tempdb
- Monitoring and Tuning the Performance of the SQL Server Disk Subsystem
- Introduction to SQL Server performance tuning tools
- SQL Server concurrency
- SQL Server Locking
- SQL Server Data Types
- Statistics
- SQL Server Indexing and Index Maintenance
- Execution Plans
- Poorly Performing Coding Practices
- Plan Guides, Query Hints, UDFs, and Computed Columns
- SQL Server Partitioning
- Optimizing Data Loading
- Database Maintenance

#### Audience

This course is intended for SQL Server administrators who are responsible for monitoring, troubleshooting and optimizing database servers and installations and SQL Server developers who are responsible for developing efficient SQL Server queries and stored procedures

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### Course Summary (cont'd)

#### Prerequisites

Before attending this course, it is recommended that students have the following skills:

- Experience with SQL Server
- Understanding of database concepts
- Experience with SQL Server administration
- Experience with Transact-SQL programming
- Knowledge of SQL Server Performance Tuning concepts

#### Duration

Five days

## SQL Server 2012 Optimization, Performance Tuning and Troubleshooting

### Course Outline

- I. SQL Server Architecture**
  - A. SQL Server Architecture
  - B. SQLOS
- II. SQL Server CPU**
  - A. Architecture of the CPU Subsystem
  - B. SMP and NUMA
  - C. Schedulers and Workers
  - D. Enhancements in SQL Server 2012
  - E. SQL Server Configurations
  - F. Affinity Mask
  - G. Parallelism
  - H. Monitoring SQL Server CPU
  - I. Monitoring and Thresholds
  - J. Tuning Methodology
- III. Introduction of SQL Server Memory Architecture**
  - A. Memory Architecture and Memory Pools
  - B. SQL Server Configurations Affecting Memory Usage
  - C. Min server memory and max server memory
  - D. Dynamic Memory
  - E. AWE
  - F. Performance Monitoring and Tuning SQL Server Memory
  - G. Monitoring and Thresholds
  - H. Tuning Methodology
- IV. SQL Server Files and Filegroups**
  - A. Files and their Usage
  - B. Filegroups and their Usage
  - C. Monitoring File Activity and Size
  - D. Lab 04: Configuring and Verifying a Database File Structure
- V. Introduction to Disk Subsystem Terminology and Architecture**
  - A. Disk Subsystem Terminology and Architecture
  - B. Disk Subsystem RAID Levels
  - C. Virtualization of SQL Server
  - D. Lab 05: Planning a SQL Server Storage Environment
- VI. Physical Architecture of Databases and Storage Internals**
  - A. Database Files
  - B. Data Compression
  - C. Lab 06: Working with Compression
- VII. Transaction Log and tempdb**
  - A. Working with the SQL Server Transaction Log
  - B. Transaction Log Architecture
  - C. Transaction Log Configuration
  - D. Working with SQL Server tempdb
  - E. Configuring tempdb
  - F. Monitoring tempdb
  - G. Lab 07: Troubleshooting tempdb Contention
- VIII. Monitoring and Tuning the Performance of the SQL Server Disk Subsystem**
  - A. Pre-installation Testing
  - B. SQLIO
  - C. Iometer
  - D. Monitoring a Running System
  - E. Wait Statistics
  - F. File I/O Statistics
  - G. Monitoring and Thresholds
  - H. Lab 08: I/O Benchmarking
- IX. Introduction to SQL Server performance tuning tools**
  - A. Windows Performance Monitor
  - B. SQL Trace and SQL Server Profiler
  - C. Extended Events
  - D. DMVs and DMFs
  - E. Database Engine Tuning Advisor
  - F. SQLDiag
  - G. Data Collector
  - H. Third-party Tools
  - I. Lab 09 A: Synchronizing SQL Server Profiler and Windows Performance Monitor Data
  - J. Lab 09 B: Working with "Deep" Events

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### Course Outline (cont'd)

- X. SQL Server concurrency**
  - A. Concurrency and Transactions
  - B. Isolation Levels
  - C. Blocking
  - D. Deadlocks
  - E. Lab 10 A: Working with the SNAPSHOT Isolation Level
  - F. Lab 10 B: Deadlock Monitoring
- XI. SQL Server Locking**
  - A. Locks
  - B. Latches
  - C. Monitoring Locks
  - D. Lab 11: Monitoring Locks
- XII. SQL Server Data Types**
  - A. Native Data Types
  - B. SQLCLR Data Types
  - C. Lab 12 A: Understanding the Impact of Improper Data Type Usage
  - D. Lab 12 B: Investigating a SQLCLR Data Type
- XIII. Statistics**
  - A. The Need for Statistics
  - B. SQL Server Statistics Objects
  - C. Creating Statistics
  - D. Maintaining Statistics
  - E. Best Practices
  - F. Lab 13: Creating and Maintaining Statistics
- XIV. SQL Server Indexing and Index Maintenance**
  - A. Heaps
  - B. Indexing Basics
  - C. Special Considerations
  - D. Special Indexes
  - E. Columnstore
  - F. XML
  - G. Spatial
  - H. FTS
  - I. Hierarchyid
  - J. Fragmentation
  - K. Correcting Fragmentation Issues
  - L. Lab 14: Understanding Fragmentation
- XV. Execution Plans**
  - A. Query Processing
  - B. Viewing Execution Plans
  - C. Plan Operators
  - D. Affecting Execution Plans
  - E. Caching and Parameterized Plans
  - F. What to Look For
  - G. Lab 15: Reading and Affecting Execution Plans
- XVI. Poorly Performing Coding Practices**
  - A. Search Arguments
  - B. Parameter Sniffing
  - C. User-defined Functions
  - D. Business Logic in Queries
  - E. Iterative Data Access
- XVII. Plan Guides, Query Hints, UDFs, and Computed Columns**
  - A. Plan Guides
  - B. Query and Table Hints
  - C. UDFs
  - D. Computed Columns
  - E. Lab 17: Understanding UDF and Computed Column Performance
- XVIII. SQL Server Partitioning**
  - A. Table and Index Partitioning
  - B. Introduction
  - C. Benefits
  - D. Components and Concepts
  - E. Partition Management
  - F. MERGE
  - G. SPLIT
  - H. SWITCH
  - I. Storage Alignment
  - J. Metadata
  - K. Lab 18: Table and Index Partitioning
- XIX. Optimizing Data Loading**
  - A. Minimally Logged Operations
  - B. Bulk Load Mechanisms
  - C. Common Scenarios
  - D. Optimizing Bulk Load Performance
- XX. Database Maintenance**
  - A. Fragmentation
  - B. Consistency

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