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Learning Style: On Demand

Technology:

Difficulty: Beginner

Course Duration: 36 Hours

Database Fundamentals



About This Course:

Database Fundamentals is a self-paced, on-demand course that gives learners a complete grounding in how database systems are designed, built, queried, and managed. Delivered through 34 interactive lessons covering 324 topics, the course starts with databases and database users, system concepts and architecture, and data modeling with the ER and Enhanced ER models, then moves into the relational data model, SQL data definition, complex queries, triggers, and views,

relational algebra and calculus, and normalization.

Learners go further into storage, indexing, query processing and optimization, transactions, concurrency control, recovery, distributed databases, NoSQL and big data systems, data mining, data warehousing and OLAP, and database security. 58 browser-based, auto-graded LiveLabs let learners practice real SQL and database tasks with no software installation, while 170 flashcards and 231 practice questions reinforce key concepts and measure progress.

Course Objectives:

- Database Concepts, Users, and Architecture
- ER and Enhanced ER Data Modeling
- The Relational Model, Relational Algebra, and Calculus
- SQL: Data Definition, Complex Queries, Triggers, and Views
- Normalization and Relational Database Design
- Storage, Indexing, Query Processing, and Optimization
- Transactions, Concurrency Control, and Recovery
- Distributed, NoSQL, and Big Data Systems
- Data Mining, Data Warehousing, and OLAP
- Database Security

Audience

Learners and professionals who need a strong, practical understanding of how databases are designed, queried, and managed, including:

- Students and Career Changers
- Junior Database Administrators
- Database and Software Developers
- Data and BI Analysts
- IT Support and Operations Staff

Prerequsites:

- None

Course Outline:

Lesson 1: Introduction

- Course overview and how to use the course

Lesson 2: Databases and Database Users

- Characteristics of the database approach
- Actors on the scene and workers behind the scene
- Advantages of using a DBMS

Lesson 3: Database System Concepts and Architecture

- Data models, schemas, and instances
- Three-schema architecture and data independence
- Database languages, interfaces, and system environment

Lesson 4: Data Modeling Using the Entity-Relationship (ER) Model

- Entity types, attributes, and keys
- Relationship types and constraints
- Weak entity types
- ER diagrams and naming conventions

Lesson 5: The Enhanced Entity-Relationship (EER) Model

- Subclasses, superclasses, and inheritance
- Specialization and generalization
- Union types and categories

Lesson 6: The Relational Data Model and Relational Database Constraints

- Relational model concepts
- Relational constraints and schemas
- Update operations and constraint violations

Lesson 7: SQL Data Definition and Data Types

- SQL data definition and data types
- Specifying constraints
- Basic retrieval queries
- INSERT, DELETE, and UPDATE statements

Lesson 8: More SQL: Complex Queries, Triggers, Views, and Schema Modification

- Complex SQL retrieval queries
- Specifying constraints as assertions and triggers
- Views (virtual tables)
- Schema change statements

Lesson 9: The Relational Algebra and Relational Calculus

- Unary and set operations
- Binary relational operations
- Additional relational operations
- Tuple and domain relational calculus

Lesson 10: Relational Database Design by ER- and EER-to-Relational Mapping

- ER-to-relational mapping
- Mapping EER model constructs to relations

Lesson 11: Introduction to SQL Programming Techniques

- Embedded and dynamic SQL
- Function calls and database APIs
- Stored procedures

Lesson 12: Web Database Programming Using PHP

- PHP basics
- Accessing databases with PHP

Lesson 13: Object and Object-Relational Databases

- Object database concepts
- Object-relational features of SQL

Lesson 14: XML: Extensible Markup Language

- Structured, semistructured, and unstructured data
- XML documents, schemas, and querying
- Extracting XML from relational databases

Lesson 15: Basics of Functional Dependencies and Normalization

- Informal design guidelines
- Functional dependencies
- Normal forms through BCNF
- Fourth and fifth normal forms

Lesson 16: Relational Database Design Algorithms and Further Dependencies

- Inference rules and equivalence
- Properties of decompositions
- Design algorithms and multivalued dependencies

Lesson 17: Disk Storage, Basic File Structures, Hashing, and Modern Storage Architectures

- Secondary storage devices
- File organizations and hashing techniques
- RAID and modern storage architectures

Lesson 18: Indexing Structures for Files and Physical Database Design

- Single-level and multilevel indexes
- B-trees and B+-trees
- Physical database design

Lesson 19: Strategies for Query Processing

- Translating SQL queries
- Algorithms for selection, join, and sorting
- Pipelining and parallel processing

Lesson 20: Introduction to Query Optimization

- Query trees and heuristic optimization
- Cost-based optimization
- Query optimization in practice

Lesson 21: Introduction to Transaction Processing Concepts and Theory

- Transactions and ACID properties
- Schedules and recoverability
- Serializability

Lesson 22: Concurrency Control Techniques

- Two-phase locking
- Timestamp ordering
- Multiversion and optimistic concurrency control

Lesson 23: Database Recovery Techniques

- Recovery concepts
- Deferred and immediate update
- Shadow paging and the ARIES algorithm

Lesson 24: Distributed Database Concepts

- Distributed database concepts
- Fragmentation, replication, and allocation
- Distributed query processing and transactions

Lesson 25: NOSQL Databases and Big Data Storage Systems

- NoSQL systems and the CAP theorem
- Document databases and MongoDB

- Key-value, column-based, and graph (Neo4j) stores

Lesson 26: Big Data Technologies Based on MapReduce and Hadoop

- MapReduce
- Hadoop Distributed File System
- YARN and big data technologies

Lesson 27: Enhanced Data Models

- Active and temporal databases
- Spatial and multimedia databases
- Deductive databases

Lesson 28: Introduction to Information Retrieval and Web Search

- Information retrieval concepts and models
- Queries, indexing, and evaluation
- Web search and analysis

Lesson 29: Data Mining Concepts

- Association rules
- Classification and clustering
- Applications of data mining

Lesson 30: Overview of Data Warehousing and OLAP

- Data warehouse concepts
- Multidimensional data models
- Building data warehouses and OLAP

Lesson 31: Database Security

- Types of security threats
- Discretionary and mandatory access control
- SQL injection
- Encryption and privacy