Database Foundations – Course Objectives

Overview

This course introduces students to basic relational database concepts. The course teaches students relational database terminology, as well as data modeling concepts, building Entity Relationship Diagrams (ERDs), and mapping ERDs. Oracle SQL Developer Data Modeler is utilized to build ERDs and The Structured Query Language (SQL) is used to interact with a relational database and manipulate date within the database. Oracle Application Express is utilized to provide practical, hands-on, engaging activities. Leveraging project-based learning techniques, students will create and work with projects which challenge them to design, implement, and demonstrate a database solution for a business or organization.

Available Curriculum Languages:

- Arabic, Simplified Chinese, English, French, Indonesian, Japanese, Brazilian Portuguese, Russian, Spanish

Duration
- Recommended total course time: 90 hours*
- Professional education credit hours for educators who complete Oracle Academy training: 30

    *Course time includes instruction, self-study/homework, practices, projects and assessment

Target Audiences

Educators
- Technical, vocational and 2- and 4- year college and university faculty members who teach computer science, information communications technology (ICT), data science, business or a related subject
- Secondary and vocational school teachers who teach computer science, ICT, or a related subject

Students
- Students who wish to learn to learn the techniques and tools to design, build and extract information from a database.
- Students who possess basic mathematical, logical, and analytical problem-solving skills
- Novice programmers, as well as those at advanced levels, who prefer to start learning the basis for the SQL programming language at an introductory level
- This foundational course is suitable for computer science majors and non-majors alike

Prerequisites

Required
- General knowledge of the purpose of a database

Suggested
- Previous experience with a database application

Suggested Next Courses
- Database Design and Programming with SQL

Lesson-by-Lesson Topics and Objectives

Section 1 – Introduction

- 1-1 Introduction to the Course
    - Identify the course goals and objectives
    - Describe the course learning strategy
    - Understand the course environment

- 1-2 Introduction to Databases
    - Differentiate between data and information
    - Define database
    - Describe the elements of a database management system (DBMS)
    - Identify the transformations in computing
    - Identify business and industry examples where database applications are used

- 1-3 Types of Database Models
    - Describe the database development process
    - Explain the common types of database models:
        - Flat file model
        - Hierarchical model
        - Network model
        - Object-oriented model
        - Relational model

- 1-4 Business Requirements
    - Explain the need for a database solution
    - Describe the importance of business rules
    - Identify guidelines and examples of writing business rules
    - Explain the importance of clearly communicating and accurately capturing information requirements

Section 2 – Databases and Data Modeling

- 2-1 Relational Databases
    - Describe the features of a single table
    - Describe the features and rules of a relational database
    - Describe the advantages and disadvantages of database types
    - Define relational tables and key terms

- 2-2 Conceptual and Physical Data Models
    - Describe a conceptual data model
    - Describe a logical data model
    - Describe a physical data model
    - Analyze the similarities and differences between conceptual and physical data models

- 2-3 Entities and Attributes
    - Identify entities
    - Identify attributes
    - Identify mandatory, optional, volatile, and nonvolatile attributes
    - Describe the Barker, Bachman, and Information Engineering notations

- 2-4 Unique Identifiers
    - Identify unique identifiers (UIDs)
    - Identify artificial unique identifiers
    - Identify composite unique identifiers
    - Identify candidate and secondary unique identifiers
    - Define primary keys

- 2-5 Relationships
    - Define and recognize examples of relationships and corresponding foreign keys
    - Identify the optionality of relationships
    - Identify the cardinality of relationships
    - Types of relationships
    - Relationship matrix

- 2-6 Entity Relationship Modeling (ERDs)
  - Describe data modelling
  - Explain "implementation-free" as it relates to data models and database design implementation
  - List the four goals of entity relationship modeling
  - Identify an entity relationship diagram (ERD)
  - Mapping relationships using ERDish
  - Construct ERD components that represent entities and attributes according to diagramming conventions

Section 3 – Refining the Data Model

- 3-1   More with Relationships
  - Resolve M:M relationships
  - Identifying barred relationships
  - Identify and illustrate nontransferable relationships
  - Identify and draw supertype and subtype entities
  - Identify hierarchical, recursive, and arc relationships

- 3-2 Tracking Data Changes
  - Keep track of data that changes over time

- 3-3   Normalization and Business Rules
  - Explain normalization
  - Describe the normal forms
  - Use normalization to validate data
  - Describe business rules

- 3-4   Data Modeling Terminology and Mapping
  - Apply terminology mapping between the logical and physical models
  - Understand and apply the Oracle naming conventions for tables and columns used in physical models
  - Apply the rules of relationship mapping to correctly transform relationships

Section 4 – Oracle SQL Developer Data Modeler

- 4-1 Oracle SQL Developer Data Modeler
  - Use Oracle SQL Developer Data Modeler to create:
    - Entities, attributes, and UIDs with correct optionality and cardinality
    - Supertype and subtype entities
    - Arc, hierarchical, barred, and recursive relationships

- 4-2 Convert a Logical Model to a Relational Model
  - Describe how to convert a logical model to a relational model in Oracle SQL Developer Data Modeler
  - List the steps to convert a logical model to a relational model
  - List the steps to convert a relational model to a logical model in Oracle SQL Developer Data Modeler

Section 5 – Mapping to the Physical Model

- 5-1 Mapping Entities and Attributes
  - Explain the naming conventions used in a relational database.
  - Use Oracle SQL Developer Data Modeler to create a glossary and apply naming standards to
    - Map entities to table names
    - Map attributes to column names

- 5-2 Mapping Primary and Foreign Keys
  - Decide on naming conventions for:
    - Primary key constraint names
    - Foreign key constraint names
    - Foreign key column names

Section 6 – Introduction to SQL

- 6-1 Introduction to Oracle Application Express
  - Distinguish between application software and system software and give an example of each
  - Log-in to the Oracle Application Express practice environment
  - Execute a simple query to retrieve information from the Database
  - Apply the rules of SQL to display all columns and a subset of columns specified by criteria

- 6-2 Structured Query Language (SQL)
  - Describe how data is organized in a relational database
  - Explain the various relational database terminologies
  - Define the structured query language and its functions
  - Describe how SQL processing takes place
  - Identify the tools used to access the relational database

- 6-3 Data Definition Language (DDL)
  - Identify the steps needed to create database tables
  - Describe the purpose of the data definition language (DDL)
  - List the DDL operations needed to build and maintain a database's tables

- 6-4 Data Manipulation Language (DML)
  - Describe the purpose of the data manipulation language (DML)
  - Explain the DML operations that are required to manage a database's table data:
    - Insert
    - Update
    - Delete

- 6-5 Transaction Control Language (TCL)
  - Describe the purpose of the Transaction Control Language (TCL)
  - Explain the TCL operations that are required to manage a transaction:
    - COMMIT
    - SAVEPOINT
    - ROLLBACK
  - Describe the need for read consistency

- 6-6 Retrieving Data Using SELECT
  - List the capabilities of SQL SELECT statements
  - Write and execute a SELECT statement that:
    - Returns all rows and columns from a table
    - Returns specific columns from a table
    - Uses column aliases to display descriptive column headings
    - Uses arithmetic and concatenation operators
    - Uses literal character strings
    - Eliminates duplicate rows
  - Describe the structure of a table

- 6-7 Restricting Data Using WHERE
  - Limit rows with:
    - WHERE clause
    - Comparison operators using =, <=, >=, <>, >, <, !=, ^=, BETWEEN, IN, LIKE and NULL conditions
    - Logical conditions using AND, OR and NOT operators
  - Describe the rules of precedence for operators in an expression

- 6-8 Sorting Data Using ORDER BY
  - Use the ORDER BY clause to sort SQL query results
  - Identify the correct placement of the ORDER BY clause within a SELECT statement
  - Using ROWNUM for Top-N-Analysis
  - Use substitution variables in the WHERE clause

- 6-9 Joining Tables Using JOIN
  - Write SELECT statements to access data from more than one table using equijoins and non-equijoins
  - Use a self-join to join a table to itself
  - Use OUTER joins view data that generally does not meet a join condition
  - Generate a Cartesian product (cross join) of all rows from two or more tables

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