

This is the first portion of the Database Design and Programming with SQL course. In this portion, students learn to analyze complex business scenarios and create a data model, a conceptual representation of an organization's information. This course outline includes section titles and descriptions, lesson titles and detailed learning objectives for each lesson.

Section 1

This section lays the foundation for understanding Oracle's role as the industry leader in database design and management for today's Internet-driven business environment. Also, this section explains the goals of the Oracle Academy, as well as Oracle's commitment to providing educational opportunities for high school students including the benefits of advanced levels of education.

Lesson 1: Introduction to the Oracle Academy

- Give examples of jobs, salary, and opportunities available that could result from participating in the Academy.
- Understand how participating in the Academy can help you to realize these opportunities.

Lesson 2: Data vs. Information

- Distinguish between data and information and provide examples of each.
- Describe and give an example of how data becomes information.

Lesson 3: History of the Database

- Describe the evolution of the database and give an example of its role in the business world.
- Name important historical contributions in database development and design.

Lesson 4. Major Transformations in Computing

- Relate major transformations enabled by changes in computing to day-to-day activities.
- Define and given an example of these terms: hardware, operating system, and software.
- Identify examples of e-businesses that use database software and explain how it is essential to their success.
- Explain the overall mission of the Oracle Corporation.

Section 2

This section discusses the purpose and function of a data model. As the foundation of database design, the data modeling process facilitates communication between designer and client preventing costly mistakes or misunderstandings in the subsequent physical database design. Data models represent the "ideal system." This "ideal" forms a sound basis for the physical database.

Lesson 1: Conceptual & Physical Models

- Describe the importance of describing information requirements.
- Distinguish between a conceptual model and the physical implementation.
- List five reasons for building a conceptual data model.
- List examples of conceptual models and physical models.

Lesson 2: Entities, Instances, Attributes and Identifiers

- Define and give an example of an entity.
- Distinguish between an entity and an instance of an entity.
- Name and describe attributes for a given entity.
- Distinguish between an attribute and its value.
- Distinguish between mandatory and optional attributes, and between volatile and nonvolatile attributes.
- Select and justify a unique identifier (UID) for an entity.

Lesson 3: Entity Relationship Modeling and ERDs

- Define the meaning of 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).

Lesson 4: Effective Questioning: Finding the Missing Link

- Understand the importance of effective questioning in gaining a complete picture of client needs.
- Complete the image and identify the "missing link" of the puzzle.
- Identify areas of the "missing link" exercise that are similar to entity relationship modeling.

Section 3

This section examines entities in more detail by identifying the attributes that describe them and the relationships between them that are of importance. Attributes represent something of significance to the business and are specific pieces of information that describe, quantify, qualify, classify, or specify an entity. This section details the process of identifying, naming, and tracking entities and attributes and identifies how relationships express how entities are mutually related. Finally, this section introduces entity relationship diagramming (ER diagramming) as well as constructing an entity relationship diagram (ERD) based on a simple business scenario.

Lesson 1: Identifying Relationships

- Interpret and describe relationship optionality.
- Interpret and describe relationship cardinality.
- Relate entities by applying the rules of cardinality and optionality.

Lesson 2: ER Diagramming Conventions

- Construct ER diagram components that represent entities and attributes according to diagramming conventions.

Lesson 3: Speaking ERDish and Drawing Relationships

- State relationships between entities in precise words (ERDish).
- Draw and label relationships correctly on an ERD.

Lesson 4: Matrix Diagrams

- Identify relationships using a matrix diagram.
- Draw an ERD from a matrix diagram.

Section 4

This section covers guidelines for modeling subtypes and supertype entities in ERDs. It also discusses the process of identifying, defining, and documenting business rules.

Lesson 1: Supertypes and Subtypes

- Define and give an example of a subtype.
- Define and give an example of a supertype.
- State the rules relating to entities and subtypes; give examples of each.
- Apply the rules of supertype and subtype by evaluating the accuracy of ER diagrams that represent them.
- Apply the rules of supertype and subtype and include them in a diagram when appropriate.

Lesson 2: Documenting Business Rules

- Define and compose a structural business rule.
- Define and compose a procedural business rule.
- Recognize that some business rules will require programming.
- Diagram business rules when they can be represented in an ER model.

Section 5

Entities are the building blocks of data modeling. The association between entities expresses how they are mutually related. This section discusses in detail establishing the relationships between entities, categorizing the different types of relationships, assessing optionality and degree, and using naming conventions. In addition, this section describes how to determine relationships that are not transferable, and looks at the differences and similarities between relationships and attributes.

Lesson 1: Relationship Transferability

- Understand the difference between transferable and nontransferable relationships.
- Describe and give an example of relationship nontransferability.
- Illustrate nontransferable relationships on ERDs.

Lesson 2: Relationship Types

- Recognize and give examples of a one-to-one relationship.
- Recognize and give examples of a one-to-many relationship.
- Recognize and give examples of a many-to-many relationship.
- Recognize redundant relationships and remove them from the ERD.

Lesson 3: Resolving Many-to-Many Relationships

- Identify attributes, which belong to many-to-many relationships.
- Demonstrate the steps to resolve a many-to-many relationship using an intersection entity.
- Identify the UID of an intersection entity and represent it in the entity relationship diagram.

Lesson 4: Understanding CRUD Requirements

- Create ER models that reflect all business rules gathered during the interview process.
- Identify the create, retrieve, update, and delete (CRUD) requirements of the business.
- Validate your ER model by performing a CRUD analysis.

Section 6

Normalization is a process for assigning attributes to entities, and further explains the steps to normalize the attributes defined in entities. This section also presents ERDs requiring normalization and asks participants to recognize the first, second, and third levels of normalization.

Lesson 1: Artificial, Composite and Secondary UID

- Define the different types of unique identifiers (UIDs).
- Define a candidate UID and explain why an entity can sometimes have more than one candidate UID.
- Analyze business rules and choose the most suitable primary UID from the candidates.
- Recognize and discuss the issues of identification in the real world.

Lesson 2: Normalization and First Normal Form

- Define the purpose of normalization in database models.
- Define the rule of First Normal Form in the normalization process.
- Determine if an entity conforms to the rule of First Normal Form.
- Convert an entity to First Normal Form if needed.

Lesson 3: Second Normal Form

- Define the rule of Second Normal Form in the normalization process.
- Examine a nonnormalized entity and determine which rule (or rules) of normalization are being violated.
- Apply the rule of Second Normal Form to resolve a violation in the model.

Lesson 4: Third Normal Form

- Identify transitive dependencies in a data model.
- Define the rule of Third Normal Form in the normalization process.
- Examine a nonnormalized entity and determine which rule (or rules) of normalization are being violated.
- Apply the rule of Third Normal Form to resolve a violation in the model.

Section 7

Constraints are business rules. This section describes the three main types of constraints – unique identifiers, arcs, and domains, as well as several categories of constraints that cannot be modeled easily. These constraints must be listed in a separate document as part of the metadata associated with the model. This section also presents two advanced data constructs, hierarchical relationships and recursive relationships. Although most data changes with time, businesses may not need to track all of it. Students learn the pros and cons of storing historical data as well as different storage techniques.

Lesson 1: Arcs

- Define the term "constraint" as it applies to data modeling.
- Identify an exclusive OR relationship in a business scenario.
- Diagram an arc constraint to represent an exclusive OR relationship.
- Distinguish between the use of an arc and a subtype in the data model.

Lesson 2: Hierarchies and Recursive Relationships

- Define and give an example of a hierarchical relationship.
- Identify the UIDs in a hierarchical model.
- Define and give an example of a recursive relationship.
- Represent a recursive relationship in an ERD given a scenario.
- Construct a model using both recursion and hierarchies to express the same conceptual meaning.

Lesson 3: Modeling Historical Data

- Identify the need to track data that changes over time.
- Construct ERD models that incorporate elements of “data over time”.
- Identify the UID of an entity that stores historical data; explain/justify the choice of UID.
- Construct a conceptual model based on a given business scenario.
- Apply the rules of entity-relationship diagramming to create an ERD that reflects the business rules.
- Present and interpret the data model to an audience.
- Compose written documentation to accompany the oral presentation and an ERD.

Section 8

This section studies the role of a consultant. Students are asked to research job descriptions for consulting positions and identify job skills required of consultants. The section concludes with tips and techniques for improving presentation skills.

Lesson 1: What is a Consultant?

- Describe the role of a consultant.
- Describe the job skills needed to be a consultant.
- Research job descriptions for consultants.
- Describe the role of the consultant and the skills necessary for the job.
- Compose a job description of a consultant based on specific project requirements.

Lesson 2: Overcoming the Fear Factor

- Describe techniques useful for overcoming the fear of speaking in public.
- Demonstrate effective techniques for public speaking.
- Apply the rules of effective public speaking to evaluate a presentation.

Section 9

This section introduces an activity that encompasses every learned in the course to this point. This activity is as challenging and fun as both instructor and student make it! The subject is Animal Shelters and students will interview the director of the animal shelter (the client), define business rules, create an ERD, present the model to the client, and finally integrate the changes requested by the client.

Lesson 1: Presentation to the Animal Shelter Client

- Share and translate the ER model with the client in an engaging way.
- Use non-technical terms when describing the ER model to the client.
- Document design revisions requested by the client.

Section 10

In this section, students learn about not being able to transfer relationships due to conditional, and time-related constraints. They will also learn about “journaling” or “logging,” a technique for tracking data that is changed or deleted. This is often an issue when the information is financial or of a sensitive nature, such as a grade change. This section concludes by inviting students to research individuals who have achieved success in the information-technology field and identify the educational background, personality traits, skills, and habits of these individuals.

Lesson 1: Modeling Change: Time

- Distinguish between using date as an attribute and DAY as an entity in a data model, depending on business requirements.
- Solve the problem of keeping characteristics of a date by constructing a model that uses DAY as an entity.
- Identify at least three time-related constraints that can result from a time-sensitive model.
- Define and give an example of conditional non-transferability in a time-constrained model.

Lesson 2: Modeling Change: Price

- Solve the business requirement of tracking changes in price or values by constructing a model that uses a historical entity.
- Describe the meaning of journaling/logging.
- Identify the business need for journaling/logging and construct a model that addresses this requirement.

Lesson 3: Adding the Time Element to the Animal Shelter ERD

- Apply the rule of using DATE as an entity successfully.
- Modify the animal-shelter ERD to accommodate new design requirements.
- Identify and design possible reports that can be produced from the data; explain how the information from these reports could be useful to the business.

Lesson 4: Leaders in Information Technology

- Use the Internet to conduct research on individuals who have achieved success in the information-technology field.
- Trace and analyze the career path of successful individuals.
- Identify personality traits, skills, and habits of successful individuals.
- Evaluate the career success of individuals by identifying their contributions to society.

Lesson 5: What About Me?

- Analyze and understand IT career options and education requirements based on interests, abilities, aptitudes, and accomplishments.

Section 11

Thinking in terms of patterns provides a valuable way to quality check conceptual data models. This section presents several generic models that assist ER modelers. These models have characteristics and rules that are generic and therefore can be applied in different contexts, thus preventing the need to reinvent models for every project. In addition, this section discusses the diagramming rules and conventions that data modelers need to follow to improve readability and clarity. These rules may prevent mistakes and inaccuracies in the end product: the database.

Lesson 1: Drawing Conventions for Readability

- Apply the Oracle drawing conventions to a data-model diagram.
- Identify high-volume entities in a data-model diagram and explain their significance to the business.
- Redraw a given data-model diagram to increase clarity and readability.
- Recognize the usefulness of dividing a complex ERD into a number of functional subdiagrams.

Lesson 2: Generic Modeling

- Define generic modeling.
- Evaluate and describe the advantages and disadvantages of generic modeling.
- Construct a generic version of a more specific data model.

Lesson 3: The Changing Nature of Work

- Research the factors that contribute to the changing nature of the job market.
- Identify five jobs or job areas that are on the decline and explain why.
- Identify five jobs or job areas that are growing and explain why.
- Articulate the changing nature of work and its associated educational requirements.
- Evaluate career choices in light of the changing nature of work.

Section 12

This section highlights the transformation of a conceptual data model into a logical database model. It describes how to transform an entity relationship model into a series of detailed definitions for tables, columns, and keys. Rules for naming conventions are discussed. Other ER structures, including various simple relationships, supertypes and subtypes, and arc relationships are covered. This section concludes by introducing the Oracle Application Express practice environment. This is an environment that allows access to an Oracle database using Structured Query Language (SQL) through a web browser.

Lesson 1: Introduction to Relational Database Concepts

- Define a primary key.
- Define a foreign key.
- Define a column-integrity rule.
- Identify row, column, primary key, unique key, and foreign key given a diagram of a table containing these elements.
- Identify violations of data-integrity rules.

Lesson 2: Basic Mapping: The Transformation Process

- Distinguish entity relationship models from database models.
- Describe the terminology mapping between a conceptual model and a relational database model.
- Understand and apply the Oracle naming conventions for tables and columns used in relational models.
- Transform an entity into a table diagram.

Lesson 3: Relationship Mapping

- Apply the rule of relationship mapping to correctly transform 1:M and barred relationships.
- Apply the rule of relationship mapping to correctly transform M:M relationships.
- Transform 1:1 relationships.
- Apply the rule of relationship mapping to correctly transform relationships in an arc.

Lesson 4: Subtype Mapping

- State and apply the table, column, identifiers, relationship, and integrity constraint rules for mapping supertype implementations.
- State and apply the table, column, identifiers, relationship, and integrity constraint rules for mapping subtype implementations.
- State and apply the table, column, identifiers, relationship, and integrity constraint rules for mapping supertype and subtype arc implementations.

Lesson 5: Introduction to Oracle Application Express: Music Tables

- Log into Oracle Application Express.
- Create the music table using the script provided.
- Enter some sample data into the music table created in this lesson.
- Query the music table to view the new data.
- Refine the query.

Section 13

This section introduces the language of the database, Structured Query Language (SQL). Students learn how to extract data from the database using the SELECT statement. They also learn the rules and guidelines needed to construct valid SQL statements. Students use Oracle Application Express to create basic SQL statements, query tables for information, add data to tables, and modify tables by adding columns.

Lesson 1: SQL Introduction: Querying the Database

- Query the MUSIC table; apply the rules of SQL to display all columns and a subset of columns specified by criteria.
- Add new data with a different value in the "type" column to the MUSIC table.
- Refine the SQL query to display only those rows in the MUSIC table that have the new type.

Lesson 2: Basic Table Modifications

- Add a new column to the MUSIC table.
- Use the DELETE and ALTER TABLE commands to correct mistakes or make revisions to a table.

Lesson 3: Teaming Up

- Demonstrate effective team-building skills.

Lesson 4: Project Overview and Getting Started

- Identify a data-modeling project to solve a business information need.
- Demonstrate essential skills in solving business problems using technology and professionally presenting these solutions.

Lesson 5: Project Management: Final Presentation Checkpoint

- Track responsibility and progress on a project by using a project-management document.
- Show evidence of progress on the final presentation project by filling in the final project-tracking grid.

Section 14

This section builds on the project management tasks introduced in the previous section by describing the System Development Life Cycle (SDLC) as a process to develop a database from concept through production. Students are asked to relate steps in SDLC to the different stages in the project-tracking grid.

Students continue to work on their final projects, building tables and populating them with sample data.

Lesson 1: System Development Life Cycle

- List and describe the different stages of the system-development life cycle.
- Identify the role of data modeling in the system-development life cycle.
- Relate the project tasks to the different stages of the system-development life cycle.

Lesson 2: Creating Tables for the Final Presentation

- Create sample tables from the final project presentation ERD.
- Add sample data to the created tables.
- Produce query output using Oracle Application Express.

Section 15

This section allows students to demonstrate their technical knowledge and professional "soft skills." Students are required to deliver a visual presentation to their "stakeholders" as well as present written documentation sufficient to convince their client that their solution meets the business requirements outlined. The final database project will consist of ERD creation, use of SQL to create and populate tables, demonstration of how this will benefit their client and a business-style, professional presentation of their material. The final project is designed for students to formulate and measure their data modeling competency. Ultimately, students will have time to reflect and assess their own performance and knowledge.

Lesson 1: Overview of Final Presentation

- Organize the final oral presentation content in logical outline order.
- Identify appropriate content for each part of the presentation.
- Assign presentation roles to each group member.

Lesson 2: Preparing Written Documentation

- Compose well-organized written documentation to accompany your presentation.
- Create a rough draft for the written documentation, review, and finalize.

Lesson 3: Preparing Visual Materials

- Construct entity relationship diagrams that demonstrate industry conventions.
- Prepare tables and visuals that support their database documentation.
- Demonstrate and provide examples of table formatting for database documentation.

Lesson 4: Review, Refine, Rehearse

- Demonstrate and refine oral presentation skills.

Lesson 5: Final Presentations

- Demonstrate the use of a central message and supporting arguments for a final presentation.
- Demonstrate logical analysis of the business rules, operations, and processes in a way that is clear and easy for the client to understand.
- Demonstrate the selection of appropriate business attire for a final presentation.
- Demonstrate the appropriate use of eye contact, upright posture, gestures, and other nonverbal communication during a final presentation.
- Demonstrate the use of clear and concise answers to all questions after a final presentation.
- Provide at least two feedback points for each presenter.

Lesson 6: You've Earned It

- See the usefulness of concepts learned and the potential applications in the world of work.
- Create a functional resume that highlights skills and experiences earned in class.

Section 16

This section covers basic SQL statements including the rules and guidelines needed to construct valid statements. In addition, arithmetic expressions and operator precedence are discussed as well as specific operators for concatenation, literal character strings, eliminating duplicate rows, and displaying NULL values. The section allows students to relate the importance of databases in everyday life and asks them to begin documenting personal achievements as a beginning step for creating a Curriculum Vitae (CV).

Lesson 1: Anatomy of a SQL Statement

- Match projection, selection, and join with their correct functions/capabilities.
- Create a basic SELECT statement.
- Use the correct syntax to display all rows in a table.
- Use the correct syntax to select specific columns in a table, modify the way data is displayed, and/or perform calculations using arithmetic expressions and operators.

Lesson 2: Oracle Database Environment

- Explain the features and benefits that the Oracle 10g Database Environment provides for businesses.
- Locate information about Oracle Corporation and its products and services.
- Relate the steps in the system development life cycle (SDLC) to the development and design of the Oracle 10g Database product and the data-modeling process.

Lesson 3: Using Applications

- Distinguish between application software and system software and give an example of each.
- Demonstrate use of Oracle Application Express to enter SQL statements that retrieve data.

Lesson 4: Relational Database Technology

- Define and give an example of a relational database.
- Identify table-key terms, including row, column, field, primary key, foreign key.
- Relate the importance of databases to everyday life.

Lesson 5: Career Portfolio: Roadmap to Your Future

- Demonstrate the process and products required for developing a Curriculum Vitae (CV), also sometimes called a career portfolio and career plan.
- Document academic achievements, certificates, awards, and leadership activities.

Section 17

Beyond the basic SELECT statement, it may be necessary to restrict the rows of data that are displayed or to specify the order in which the rows are displayed. This section demonstrates the use of the WHERE clause to restrict retrieval of rows, the use of comparison conditions that compare one value to another value or expression and the use of BETWEEN, IN, LIKE and NULL. In addition, the logical conditions using AND, OR, and NOT and the ORDER BY clause are shown. Work experience and community involvement are an excellent way of developing skills that employers and college admissions boards look for in a candidate. This section guides students through the process of reviewing their work and community experience and presenting it in the form of a CV or professional resume.

Lesson 1: Working with Columns, Characters, and Rows

- Apply the concatenation operator to link columns to other columns, arithmetic expressions, or constant values to create a character expression.
- Use Column Aliases, to rename columns in the query result.
- Enter literal values of type character, number, or date into a SELECT statement.
- Define and use DISTINCT to eliminate duplicate rows.
- Display the structure of a table using DESCRIBE or DESC.
- Edit, execute, and save SQL statements in Oracle Application Express.

Lesson 2: Limit Rows Selected

- Apply SQL syntax to restrict the rows returned from a query.
- Demonstrate application of the WHERE clause syntax.
- Explain why it is important, from a business perspective, to be able to easily limit data retrieved from a table.
- Construct and produce output using a SQL query containing character strings and date values.

Lesson 3: Comparison Operators

- Apply the proper comparison operator to return a desired result.
- Demonstrate proper use of BETWEEN, IN, and LIKE conditions to return a desired result.
- Distinguish between zero and the value of NULL as unavailable, unassigned, unknown, or inapplicable.
- Explain the use of comparison conditions and NULL.

Lesson 4: Work Experience and Community Involvement

- Document personal work experience and community involvement activities.
- Prepare a draft CV.
- Identify personal qualities that employers, college/university admissions officers, and/or military officials seek in a candidate.

Section 18

It is often desirable to be able to restrict and sort the rows returned by a query. This section introduces the conditional operators, AND, OR, and NOT as well as the logical conditions, IN and NOT IN to restrict the number of rows returned based on two or more conditions. It also presents the rules of precedence defining the order in which expressions are evaluated and calculated as well as the syntax for sorting query output. The last lesson introduces students to functions and distinguishes between single-row and multi-row functions.

Lesson 1: Logical Comparisons and Precedence Rules

- Evaluate logical comparisons to restrict the rows returned based on two or more conditions.
- Apply the rules of precedence to determine the order in which expressions are evaluated and calculated.

Lesson 2: Sorting Rows

- Construct a query to sort a results set in ascending or descending order.
- State the order in which expressions are evaluated and calculated based on the rules of precedence.
- Construct a query to order a results set using a column alias.
- Construct a query to order a results set for single or multiple columns.

Lesson 3: Mock Interview

- Use Internet resources to identify and construct a list of interview questions for a businessperson in the IT field.
- Conduct a mock business interview.
- Demonstrate appropriate demeanor and dress as the interviewer.
- Constructively critique the mock interview and suggest improvements for the interview process.

Lesson 4: Introduction to Functions – Single Row Functions

- Identify appropriate applications of single-row functions in query statements.
- Classify a function as a single-row or multi-row function.
- Differentiate between single-row functions and multi-row functions and the result returned by each.