Database Programming with SQL

1-2

Relational Database Technology

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Objectives

This lesson covers the following objectives:

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

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Purpose

- Databases are part of our everyday lives even though most of the time we don't even think about them
- If you have ever made an airline reservation, used an ATM machine, or made a mobile-phone call, you've used a database
- In fact, many cities use intelligent traffic guiding system databases to control stoplights
- So the next time you're waiting at a red light, it may be a database that is responsible for your delay!
- In this lesson, you will learn more about databases and how they're organized and created

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Some interesting databases found on the internet:

www.rcdb.com (roller coaster database – lots of information and searchable)

www.classical.net (online music database that links to many other databases)

www.rangercentral.com (Power Rangers database)

www.museumstuff.com (list of 1,000 museums – great exploring)

www.drewsullivan.com (the journalist's database of databases – super interesting)

Relational Databases

- A relational database allows tables to be related by means of a common field
- As few as two tables can be considered a relational database if they share a common field

COUNTRY_ID	COUNTRY_NAME	REGION_ID
CA	Canada	2
DE	Germany	1
UK	United Kingdom	1
US	United States of America	2

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Relational database: Collections of objects or relations, set of operators to act on those relations, and data integrity for accuracy and consistency.

Field: Intersection of a row and column.

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Relational Databases

- Realistically, databases used in business have many tables, each table sharing a common field with another table
- The "countries" table shown is one of several tables in the Employees database and just one example of the many tables that will be used in this course

COUNTRY_ID	COUNTRY_NAME	REGION_ID
CA	Canada	2
DE	Germany	1
UK	United Kingdom	1
US	United States of America	2

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The "Region_id" column in this table is a common field with the "regions" table.

Relational Databases

- To understand how important databases have become in today's world, consider the following statistics:
  - Currently 20% of the world's data resides in RDBMSs
  - In the next two years, databases are expected to grow larger than 100 terabytes
  - A database this big would be able to store 100,000 copies of the Encyclopedia Britannica or 200,000 hours of music or about 10 billion web pages

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RDBMS: A relational database management system.

Relational Databases

- Some of the top 10 world's largest databases using the Oracle RDBMS are:
  - France Telecom, 29.2TB -- a communications company (a TB is a terabyte equivalent to 1,000 gigabytes)
  - Amazon.com with, 13 TB -- selling books and merchandise
  - The Claria Corporation,12TB -- Internet behavioral marketing company tracking Internet user behavior

Review Key Terms

- Let's review the following key terms:
  - table -- basic storage structure
  - column -- one kind of data in a table
  - row -- data for one table instance
  - field -- the one value found at the intersection of a row and a column
  - primary key -- unique identifier for each row
  - foreign key -- column that refers to a primary-key column in another table

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Properties of Tables

- There are six properties of tables in a relational database:
  - Property 1: Entries in columns are single-valued
  - Property 2: Entries in columns are of the same kind
  - Property 3: Each row is unique
  - Property 4: Sequence of columns is insignificant
  - Property 5: Sequence of rows is insignificant
  - Property 6: Each column has a unique name

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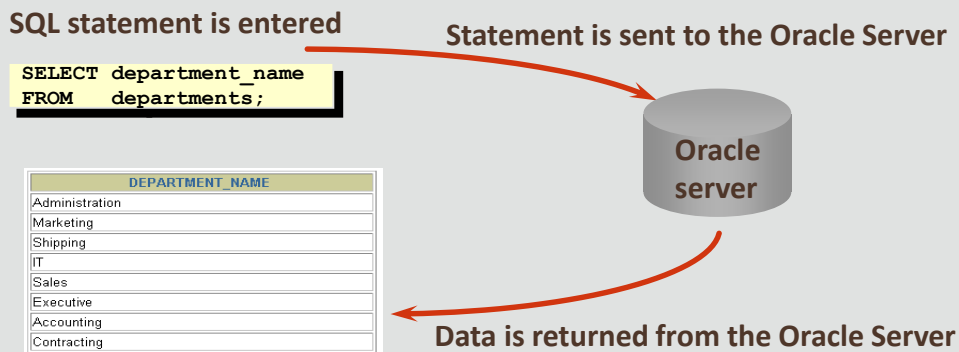Relational Database Technology

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Accessing Data in an RDBMS

- A relational database-management system (RDBMS) organizes data into related rows and columns

- To access the data in a database, you do not need to know where the data is located physically, nor do you need to specify an access route to the tables

- You simply use structured query language (SQL) statements and operators

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Communicating with Databases

- Working with the database is very similar to calling up and talking to a friend on the phone
  - First, you must choose a method to communicate (the phone)
  - Once connected, you ask your friend a question (a query)
  - In response to your question, your friend answers (return of data)
- Pretty simple, and most of us are experts at this
- In this class, our method of communication with the database will be through Oracle Application Express
- When you ask a question using SQL, the application will return an answer

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Communicating With Databases

- As shown in the diagram, communicating with an RDBMS is accomplished by entering a SQL statement in Oracle Application Express

SQL statement is entered

Statement is sent to the Oracle Server

```
SELECT department_name
FROM   departments;
```

DEPARTMENT_NAME
Administration
Marketing
Shipping
IT
Sales
Executive
Accounting
Contracting

Oracle server

Data is returned from the Oracle Server

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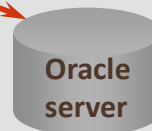
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Communicating With Databases

- The request is then sent to the Oracle Server (a database running on a computer), the request is processed and the data returned is displayed

SQL statement is entered

Statement is sent to the Oracle Server

```
SELECT department_name
FROM   departments;
```

DEPARTMENT_NAME
Administration
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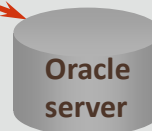
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Communicating With Databases

- In very large database systems, many users, servers, and tables make up the RDBMS

SQL statement is entered

```
SELECT department_name
FROM   departments;
```

DEPARTMENT_NAME
Administration
Marketing
Shipping
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Contracting

Statement is sent to the Oracle Server

Oracle server

Data is returned from the Oracle Server

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Categories of SQL Statements

- SQL statements are grouped into several categories depending on the functions they perform
- During this course, you will learn how to use SQL to execute these statements
- The data retrieval statement retrieves data from the database using the keyword SELECT

Categories of SQL Statements

- There are four main categories of SQL statements:
  - Data manipulation language (DML)
  - Data definition language (DDL)
  - Transaction control language (TCL)
  - Data control language (DCL)

Categories of SQL Statements

- Data manipulation language (DML)
  - DML statements begin with INSERT, UPDATE, DELETE, or MERGE and are used to modify the table data by entering new rows, changing existing rows, or removing existing rows
- Data definition language (DDL)
  - DDL statements create, change, and remove data structures from the database
  - The keywords CREATE, ALTER, DROP, RENAME, and TRUNCATE begin DDL statements

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The SELECT statement is a limited form of DML statement in that it can only access data in the database. It cannot manipulate data in the database, although it can operate on the accessed data before returning the results of the query.

Categories of SQL Statements

- Transaction control language (TCL)
  - TCL statements are used to manage the changes made by DML statements
  - Changes to the data are executed using COMMIT, ROLLBACK, and SAVEPOINT
  - TCL changes can be grouped together into logical transactions
- Data control language (DCL)
  - DCL keywords GRANT and REVOKE are used to give or remove access rights to the database and the structures within it

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Terminology

Key terms used in this lesson included:
- Data control language (DCL)
- Data definition language (DDL)
- Data manipulation language (DML)
- Field
- Foreign key
- RDBMS

Terminology

Key terms used in this lesson included:

- Primary key
- Relational database
- Row
- Table
- Transaction control (TCL)

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Summary

In this lesson, you should have learned how to:
- Define and give an example of a relational database
- Identify table-key terms, including row, column, field, primary key, and foreign key
- Relate the importance of databases to everyday life