INTRODUCTION

revised by 김태연

KROENKE AND AUER - DATABASE PROCESSING, 13th Edition © 2014 Pearson Education, Inc.

OBJECTIVES

➤ To understand the characteristics of databases

➤ To survey some important and interesting database applications

➤ To gain a general understanding of tables and relationships

➤ To describe the components of an enterprise-class database system and explain the functions they perform

➤ To define the term database management system (DBMS) and describe the functions of a DBMS

➤ To define and understand database design from existing data, as new systems development, and in database redesign

CHARACTERISTICS OF DATABASES

➤ The purpose of a database is to help people track things of interest to them.

➤ Data is stored in tables, which have rows and columns like a spreadsheet. A database may have multiple tables, where each table stores data about a different thing.

➤ Each row in a table stores data about an occurrence or instance of the thing of interest.

➤ A database stores data and relationships.

DATA IN TABLES

The STUDENT table

The CLASS table

The GRADE table —but who do these grades belong to?

STUDENT

StudentNumber	LastName	FirstName	EmailAddress
1	Cooke	Sam	Sam.Cooke@OurU.edu
2	Lau	Marcia	Marcia.Lau@OurU.edu
3	Harris	Lou	Lou.Harris@OurU.edu
4	Greene	Grace	Grace.Greene@OurU.edu
(New)			

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CLASS

ClassNumber	ClassName	Term	Section
10	CHEM 101	2014-Fall	1
20	CHEM 101	2014-Fall	2
30	CHEM 101	2015-Spring	1
40	ACCT 101	2014-Fall	1
50	ACCT 101	2015-Spring	1

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GRADE

Grade
3.7
3.5
3.7
3.1
3.0
3.5
0.0

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Table names are written with

all capital letters:STUDENT, CLASS, GRADE
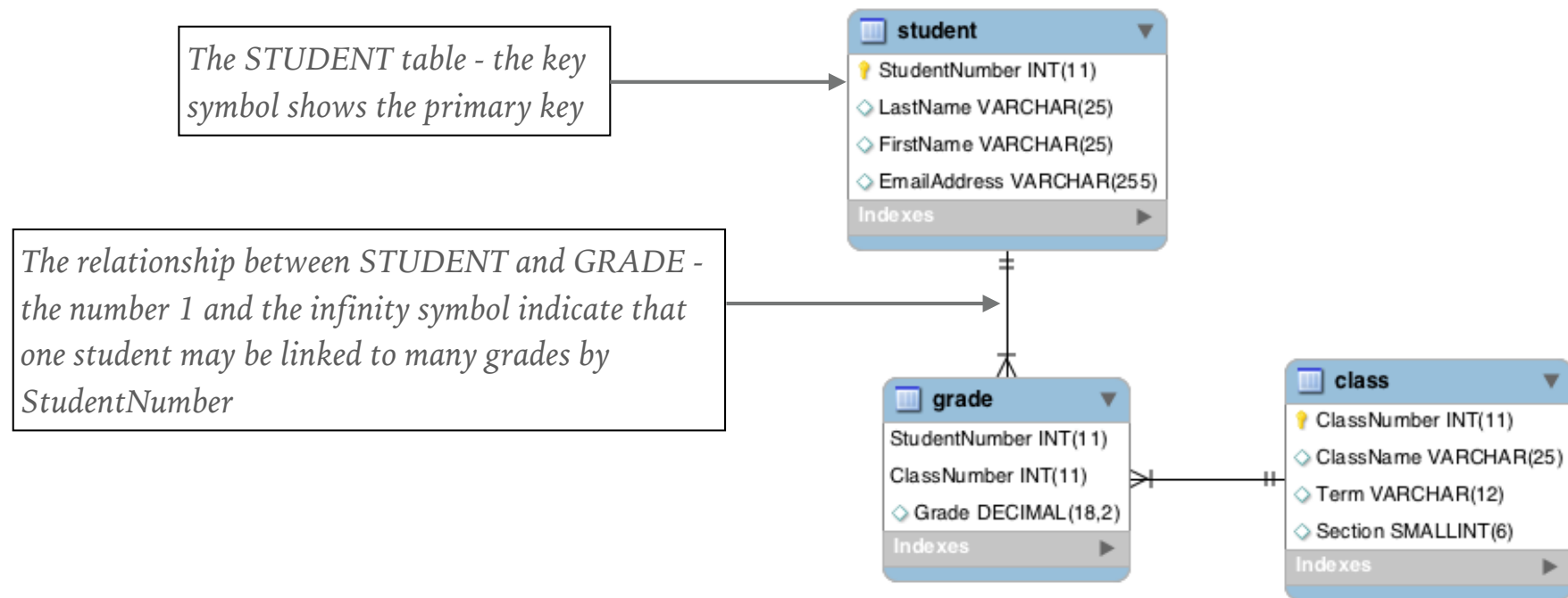
Column names are written with

an initial capital letter: Term, Section, ClassNumber, StudentName

DATABASE HAS DATA AND RELATIONSHIPS

The STUDENT table

The CLASS table

The GRADE table with foreign keys—now each grade is linked back to the STUDENT and CLASS tables

STUDENT

StudentNumber	LastName	FirstName	EmailAddress
1	Cooke	Sam	Sam.Cooke@OurU.edu
2	Lau	Marcia	Marcia.Lau@OurU.edu
3	Harris	Lou	Lou.Harris@OurU.edu
4	Greene	Grace	Grace.Greene@OurU.edu
(New)			

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CLASS

ClassNumber	ClassName	Term	Section
10	CHEM 101	2014-Fall	1
20	CHEM 101	2014-Fall	2
30	CHEM 101	2015-Spring	1
40	ACCT 101	2014-Fall	1
50	ACCT 101	2015-Spring	1

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GRADE

StudentNumber	ClassNumber	Grade
1	10	3.7
1	40	3.5
2	20	3.7
3	30	3.1
4	40	3.0
4	50	3.5
		0.0

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DATABASE CREATE INFORMATION

➤ Data = recorded facts and figures

➤ Information = knowledge derived from data

  ➤ Student' GPA, the average GPA for a class , etc.

The STUDENT table - the key symbol shows the primary key

student
🔑 StudentNumber INT(11)
◇ LastName VARCHAR(25)
◇ FirstName VARCHAR(25)
◇ EmailAddress VARCHAR(255)
Indexes

The relationship between STUDENT and GRADE - the number 1 and the infinity symbol indicate that one student may be linked to many grades by StudentNumber

grade
StudentNumber INT(11)
ClassNumber INT(11)
◇ Grade DECIMAL(18,2)
Indexes

class
🔑 ClassNumber INT(11)
◇ ClassName VARCHAR(25)
◇ Term VARCHAR(12)
◇ Section SMALLINT(6)
Indexes

COMPONENT OF A DATABASE SYSTEM WITH SQL

➤ Database system is typically defined to consist of four components: users, the database application, the database management system (DMBS), and the database.

➤ + SQL
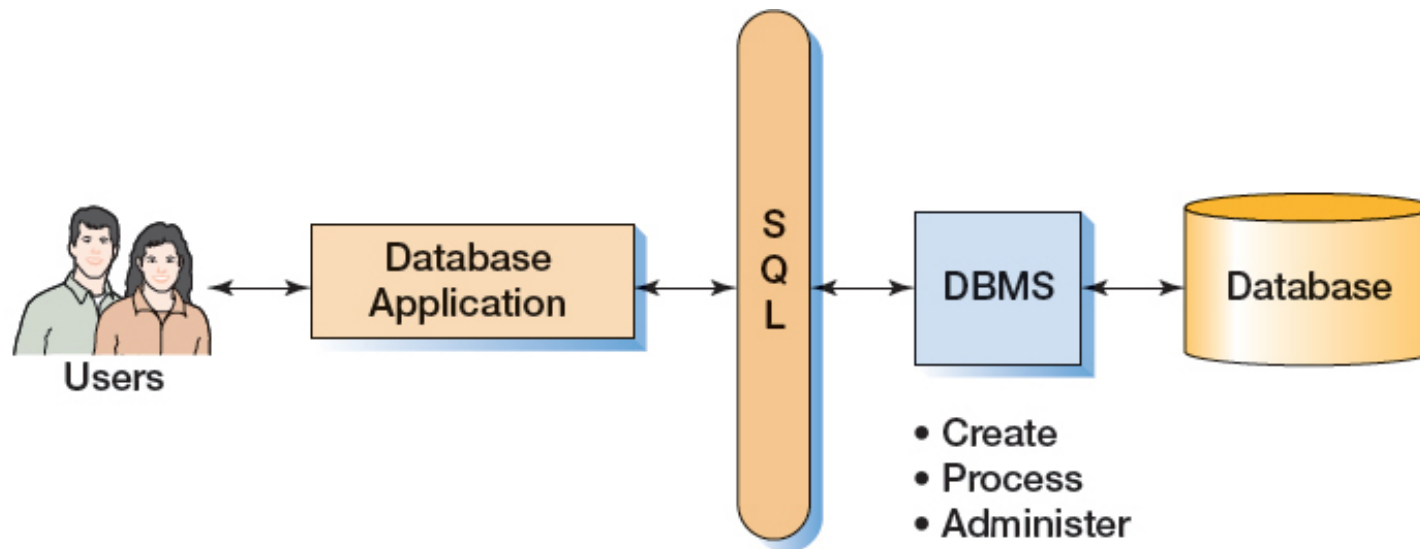
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EXAMPLE DATABASE APPLICATIONS

➤ Database application is a set of one or more computer programs that serves as an intermediary between the user and the DBMS

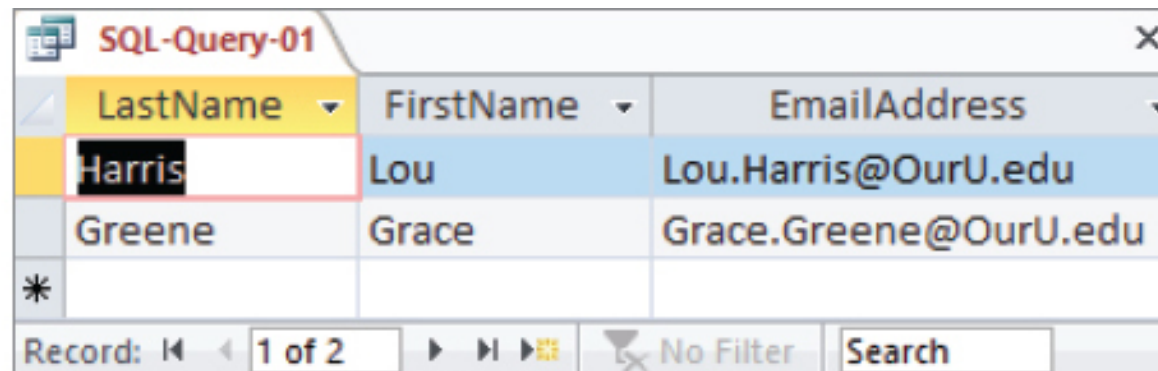| Application	Example Users	Number of Users	Typical Size	Remarks
Sales contact manager	Salesperson	1	2,000 rows	Products such as GoldMine and Act! are database centric.
Patient appointment (doctor, dentist)	Medical office	15 to 50	100,000 rows	Vertical market software vendors incorporate databases into their software products.
Customer relationship management (CRM)	Sales, marketing, or customer service departments	500	10 million rows	Major vendors such as Microsoft and Oracle PeopleSoft Enterprise build applications around the database.
Enterprise resource planning (ERP)	An entire organization	5,000	10 million+ rows	SAP uses a database as a central repository for ERP data.
E-commerce site	Internet users	Possibly millions	1 billion+ rows	Drugstore.com has a database that grows at the rate of 20 million rows per day!
Digital dashboard	Senior managers	500	100,000 rows	Extractions, summaries, and consolidations of operational databases.
Data mining	Business analysts	25	100,000 to millions+	Data are extracted, reformatted, cleaned, and filtered for use by statistical data mining tools.

Basic Function of Application Programs

- Create and process forms
- Process user queries
- Create and process reports
- Execute application logic
- Control application

DATABASE APPLICATION – FORMS

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DATABASE APPLICATION – QUERIES

```
SELECT LastName, FirstName, EmailAddress

FROM STUDENT

WHERE StudentNumber > 2;
```

SQL-Query-01			X
LastName ▾	FirstName ▾	EmailAddress	▾
Harris	Lou	Lou.Harris@OurU.edu	
Greene	Grace	Grace.Greene@OurU.edu	
*			

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EXAMPLE REPORT

Class Grade Report

ClassNumber	ClassName	Term	Section	LastName	FirstName	Grade
10	CHEM 101	2014-Fall	1			
				Cooke	Sam	3.7
20	CHEM 101	2014-Fall	2			
				Lau	Marcia	3.7
30	CHEM 101	2015-Spring	1			
				Harris	Lou	3.1
40	ACCT 101	2014-Fall	1			
				Cooke	Sam	3.5
				Greene	Grace	3.0
50	ACCT 101	2015-Spring	1			
				Greene	Grace	3.5

SQL

➤ Structured Query Language(SQL): standard language that is understood by all commercial DBMS products

  ➤ ANSI/ISO/IEC 9075-1:2003, Information technology—Database languages—SQL—Part 1: Framework (SQL/Framework)

  ➤ ANSI/ISO/IEC 9075-2:2003, Information technology—Database languages—SQL—Part 2: Foundation (SQL/Foundation)

  ➤ ISO/IEC 9075-1:2003, Information technology—Database languages—SQL—Part 1: Framework (SQL/Framework)

  ➤ ISO/IEC 9075-2:2003, Information technology—Database languages—SQL—Part 2: Foundation (SQL/Foundation)

➤ MySQL Standards Compliance

  ➤ http://dev.mysql.com/doc/refman/5.7/en/compatibility.html

American National Standards Institute (ANSI), the International Organization for Standardization (ISO)

SQL EXAMPLES

➤ Data Manipulation Language (DML)

```
SELECT * FROM STUDENT;


INSERT INTO STUDENT (LastName, FirstName, EmailAddress)
VALUES ('Minsu', 'Lee', 'minsu@busan.ac.kr');


UPDATE STUDENT
SET EmailAddress = 'minsu@pusan.ac.kr'
WHERE LastName = 'Minsu';


DELETE FROM STUDENT
WHERE LastName = 'Minsu';
```

➤ Data Definition Language (DDL)

```
CREATE TABLE `student` (
  `StudentNumber` int(11) NOT NULL DEFAULT '0',
  `LastName` varchar(25) DEFAULT NULL,
  `FirstName` varchar(25) DEFAULT NULL,
  `EmailAddress` varchar(255) DEFAULT NULL,
  PRIMARY KEY (`StudentNumber`)
) ENGINE=InnoDB DEFAULT CHARSET=utf8;
```

SQL EXAMPLES

DDL

```
CREATE TABLE `student` (
  `StudentNumber` int(11) NOT NULL DEFAULT '0',
  `LastName` varchar(25) DEFAULT NULL,
  `FirstName` varchar(25) DEFAULT NULL,
  `EmailAddress` varchar(255) DEFAULT NULL,
  PRIMARY KEY (`StudentNumber`)
) ENGINE=InnoDB DEFAULT CHARSET=utf8;
```

DML

```
SELECT * FROM STUDENT;

INSERT INTO STUDENT (LastName, FirstName, EmailAddress)
VALUES ('Minsu', 'Lee', 'minsu@busan.ac.kr');

UPDATE STUDENT
SET EmailAddress = 'minsu@pusan.ac.kr'
WHERE LastName = 'Minsu';

DELETE FROM STUDENT
WHERE LastName = 'Minsu';
```

DBMS

➤ Database management system(DBMS), creates, processes, and administers the database

➤ DBMS is a large, complicated product that is almost always licensed from a software vendor

FUNCTIONS OF DBMS

Functions of a DBMS
Create database
Create tables
Create supporting structures (e.g., indexes)
Modify (insert, update, or delete) database data
Read database data
Maintain database structures
Enforce rules
Control concurrency
Perform backup and recovery

THE DATABASE

➤ A database is a self-describing collection of integrated tables.

➤ The tables are called integrated because they store both data and the relationships among the data.

➤ A database is called self-describing because it stores a description of itself.

➤ Such descriptive data is called metadata, which is data about data.

The STUDENT table

The CLASS table

The GRADE table with foreign keys—now each grade is linked back to the STUDENT and CLASS tables

```
SELECT table_name, table_type, engine

FROM information_schema.tables

WHERE table_schema = 'IE'
```

GENERIC METADATA TABLES AND OTHER ELEMENTS

USER_TABLES Table

TableName	NumberColumns	PrimaryKey
STUDENT	4	StudentNumber
CLASS	4	ClassNumber
GRADE	3	(StudentNumber, ClassNumber)

USER_COLUMNS Table

ColumnName	TableName	DataType	Length (bytes)
StudentNumber	STUDENT	Integer	4
LastName	STUDENT	Text	25
FirstName	STUDENT	Text	25
EmailAddress	STUDENT	Text	100
ClassNumber	CLASS	Integer	4
Name	CLASS	Text	25
Term	CLASS	Text	12
Section	CLASS	Integer	4
StudentNumber	GRADE	Integer	4
ClassNumber	GRADE	Integer	4
Grade	GRADE	Decimal	(2, 1)
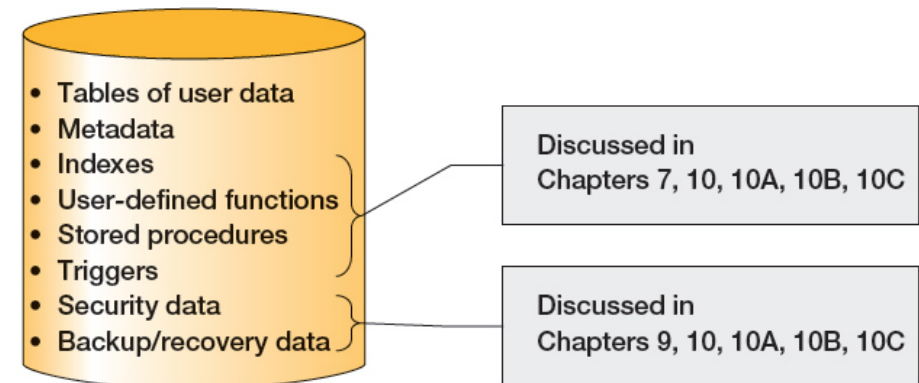
- Tables of user data
- Metadata
- Indexes
- User-defined functions
- Stored procedures
- Triggers
- Security data
- Backup/recovery data

Discussed in
Chapters 7, 10, 10A, 10B, 10C

Discussed in
Chapters 9, 10, 10A, 10B, 10C
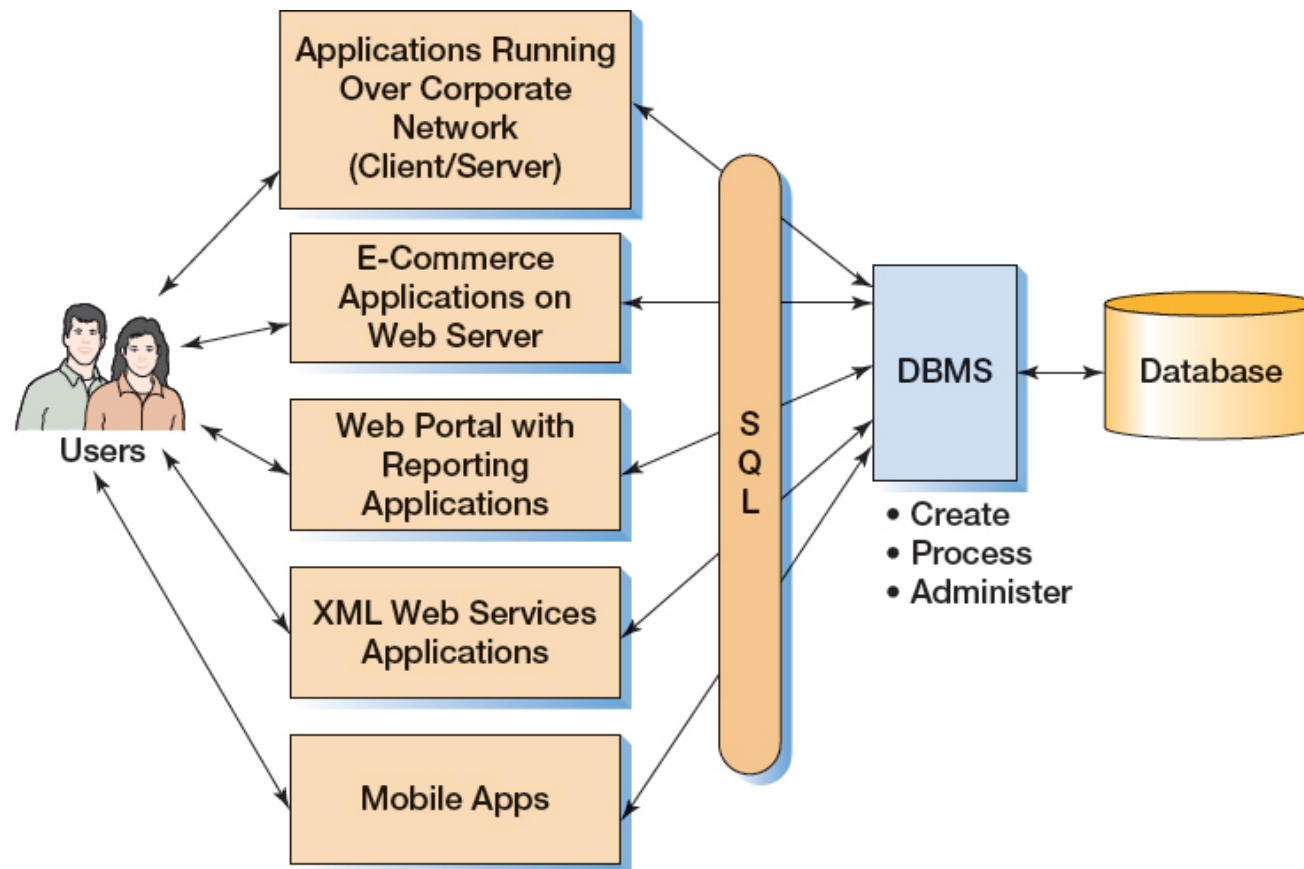
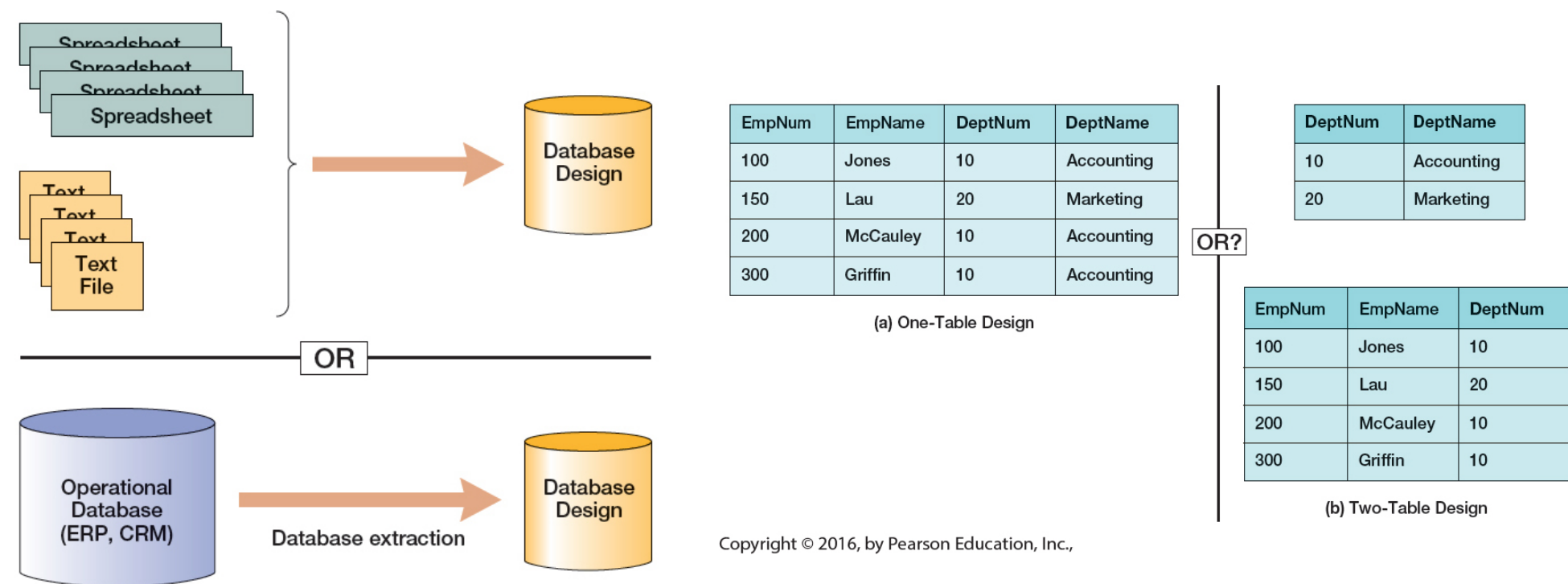Copyright © 2016, by Pearson Education, Inc.,

DATABASE DESIGN

➤ Database design from existing data

➤ Database design for new system development

➤ Database redesign of an existing database

Types of Database Design Process
• From existing data (Chapters 3 and 4)
Analyze spreadsheets and other data tables
Extract data from other databases
Design using normalization principles
• New systems development (Chapters 5 and 6)
Create data model from application requirements
Transform data model into database design
• Database redesign (Chapter 8)
Migrate databases to newer databases
Integrate two or more databases
Reverse engineer and design new databases using normalization principles and data model transformation

Note: Chapter 7 discusses database implementation using SQL. You need that knowledge before you can understand database redesign.
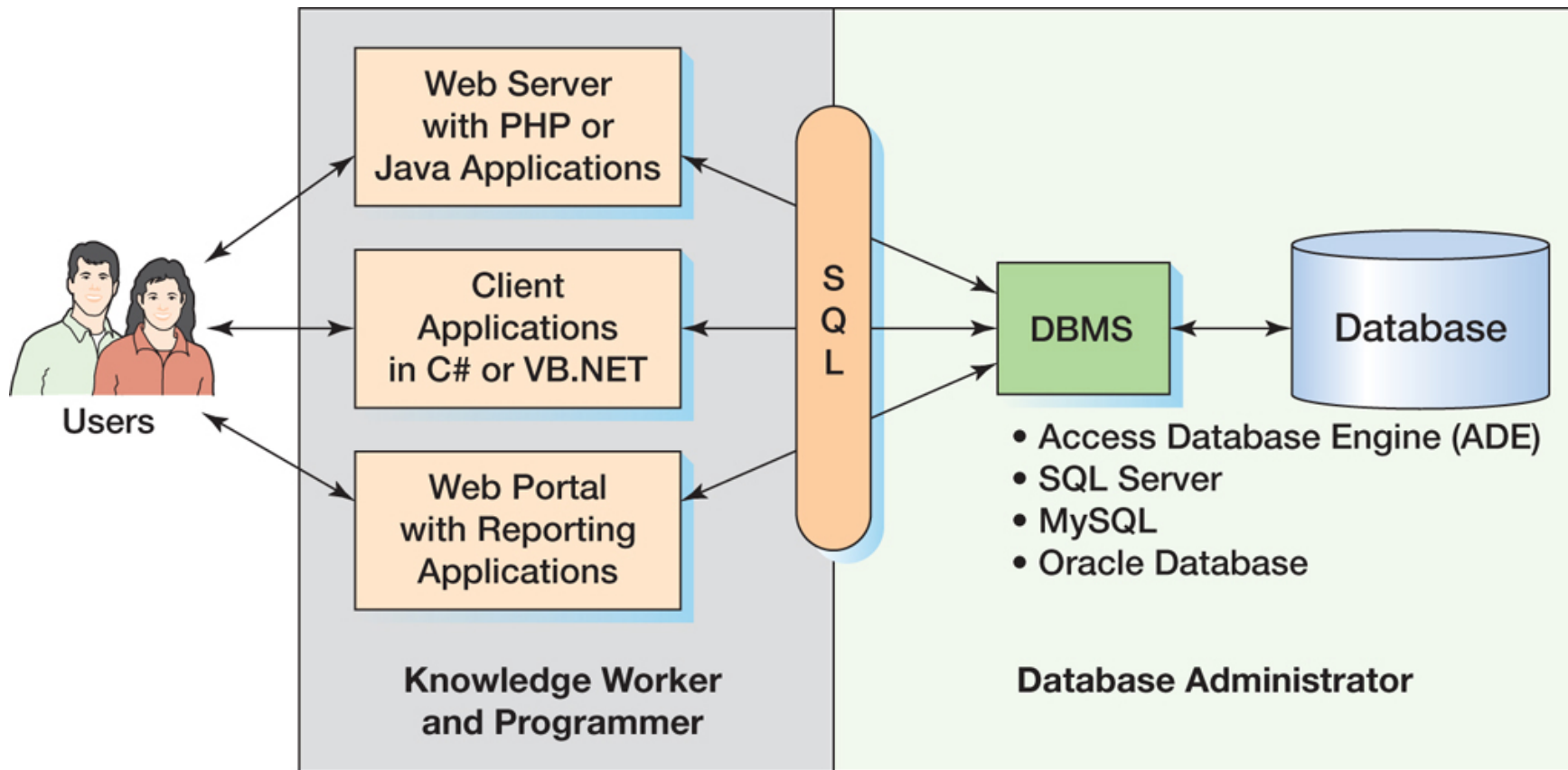
DATABASE DESIGN FROM EXISTING DATA

EmpNum	EmpName	DeptNum	DeptName
100	Jones	10	Accounting
150	Lau	20	Marketing
200	McCauley	10	Accounting
300	Griffin	10	Accounting

(a) One-Table Design

OR?

DeptNum	DeptName
10	Accounting
20	Marketing

EmpNum	EmpName	DeptNum
100	Jones	10
150	Lau	20
200	McCauley	10
300	Griffin	10

(b) Two-Table Design

WORKING DOMAINS

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