



Chapter 1 Introduction

Hongyu Gao
June 8, 2022



Agenda

Lecture on Chapter 1

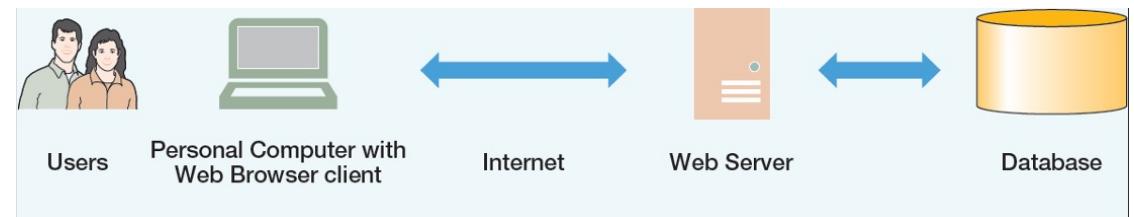
Quiz 1 review

In-class Exercise 1

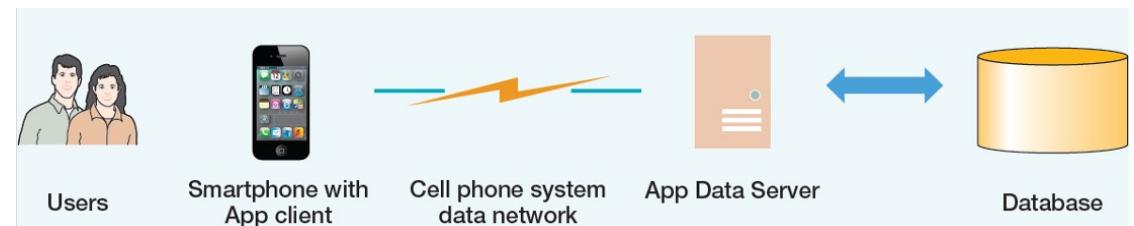
Chapter 1 Introduction

Application Architectures

- Browser-Server (B-S) Architecture



- Client-Server (C-S) Architecture



Chapter 1 Introduction

A Database System

SQL: Structured Query Language

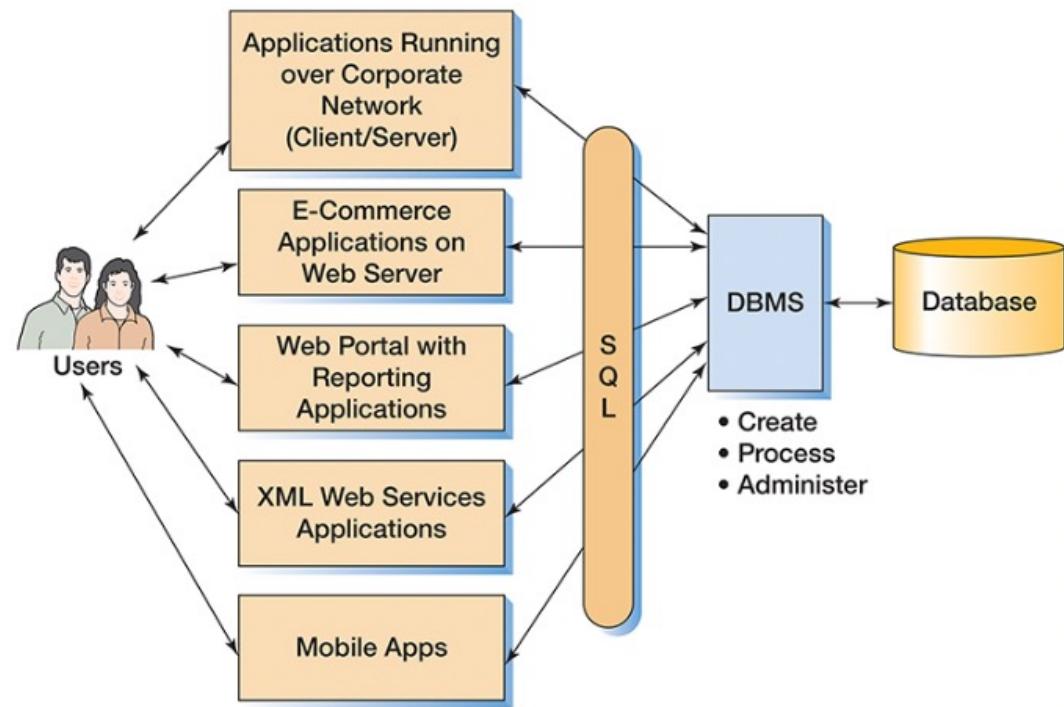
- A standard language for storing, manipulating, and retrieving data in relational databases.
- An internationally recognized standard database language that is used by all commercial DBMS.

```
SELECT LastName, FirstName, EmailAddress  
FROM STUDENT  
WHERE StudentNumber > 2;
```

XML: Extensible Markup Language

- A simple text-based format for representing structured information.
- A powerful way to store data in a format that can be stored, searched, and shared.

- Components of a Database System



Chapter 1 Introduction

Characteristics of Relational Databases

Data

- The recorded raw or processed information

Information

- The knowledge derived from data

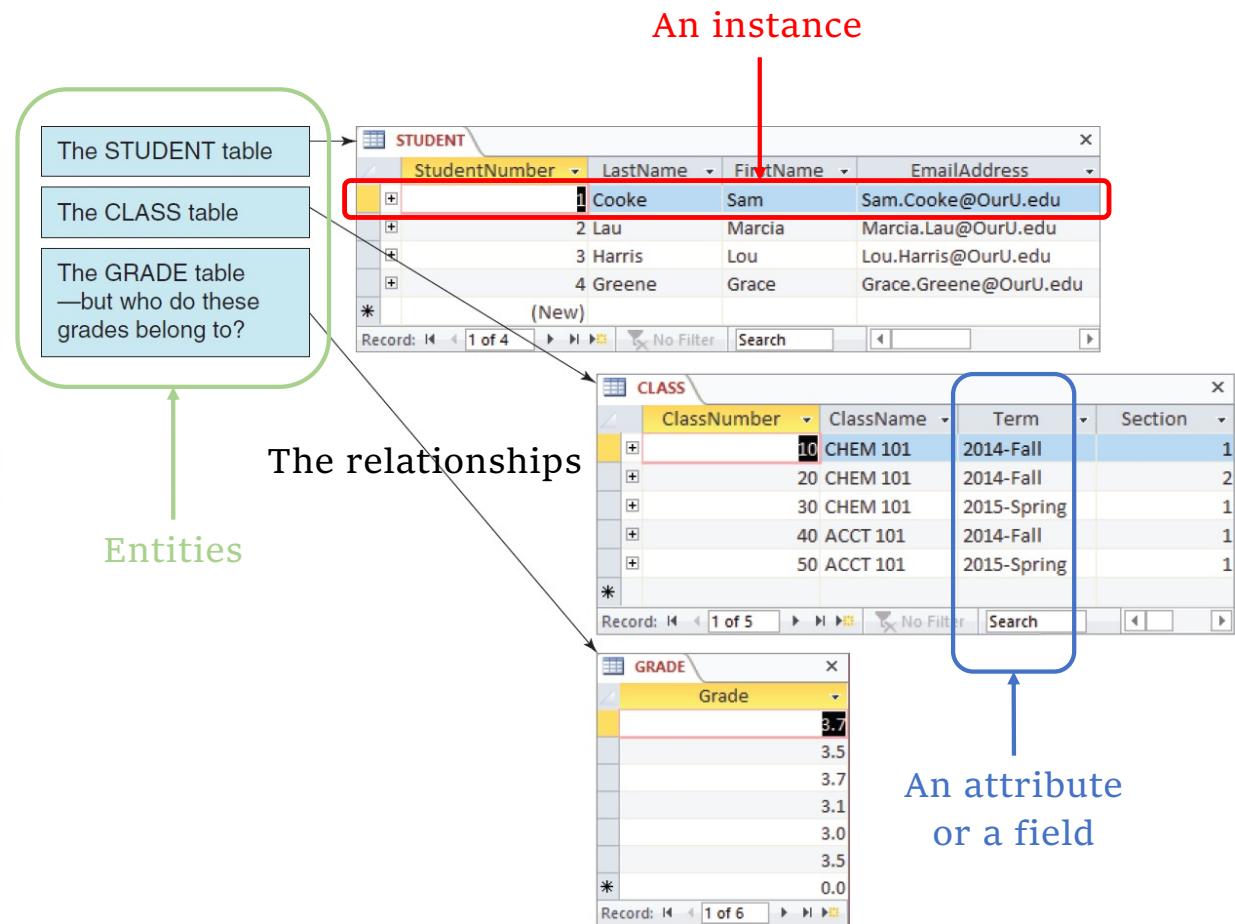
- Database
 - A self-describing collection of integrated tables.
- Integrated Tables
 - The tables that include the data and the relationships between the rows of the data
- Self-Describing
 - The database include the description data of itself.
 - The self-describing data is called **Meta Data**, which is the data about data.

Chapter 1 Introduction

Components of a Relational Database

A Relational Database Consists of

- Entities, i.e. tables
- Instances, i.e. rows
- Attributes or Fields, i.e. columns
- Relationship between entities, i.e. the keys



Chapter 1 Introduction

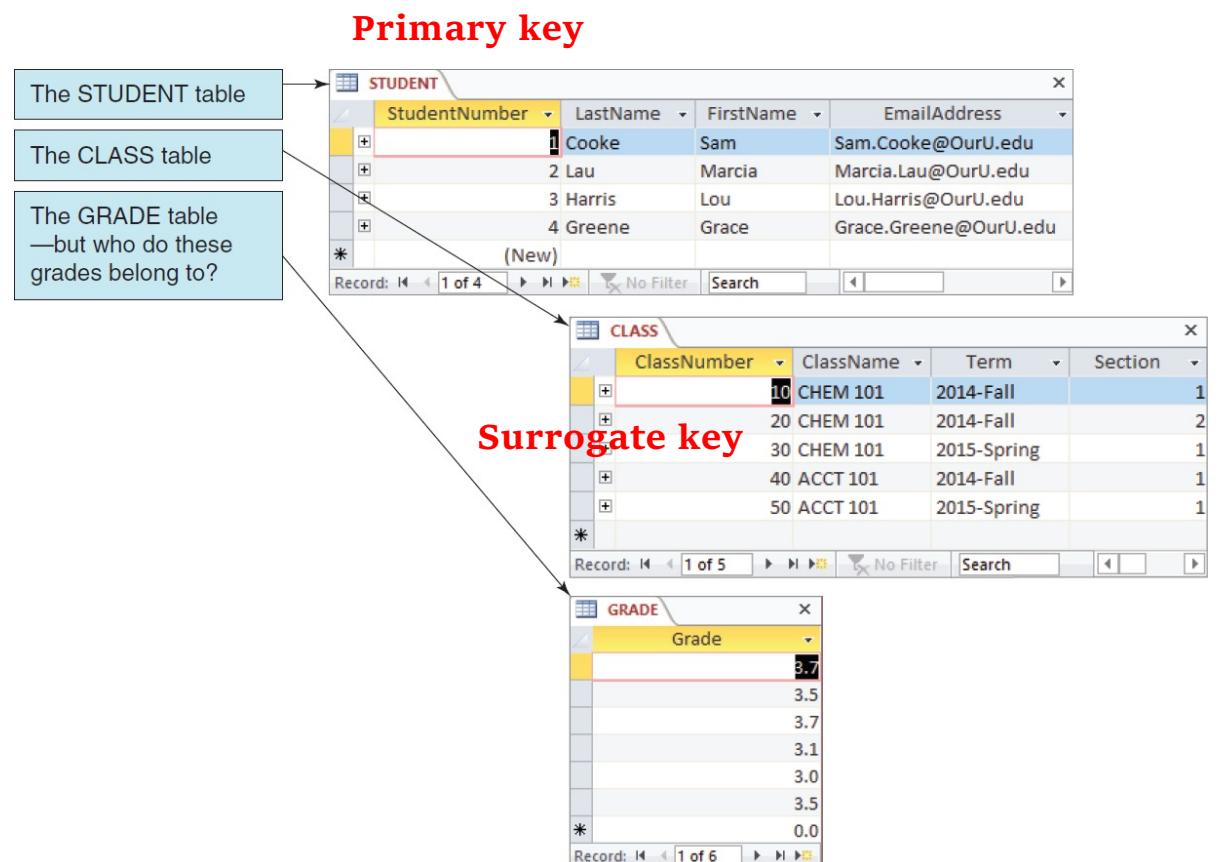
Data and Tables

Primary Key:

- A unique identifier in a table

Surrogate Key:

- A primary key that is automatically assigned by the computer



Chapter 1 Introduction

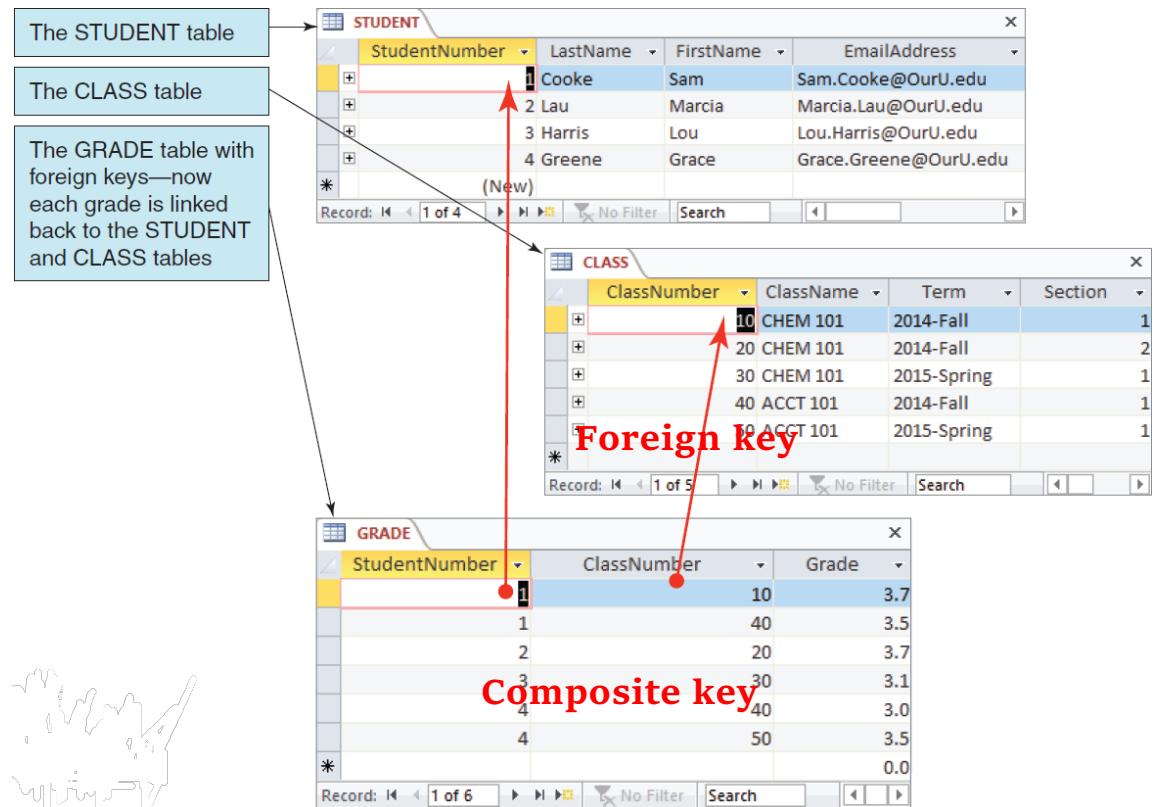
Related Tables

Composite Key:

- A primary key that consists of two or more attributes (fields)

Foreign Key:

- A primary key in one table that is used as an identifier in another table



Chapter 1 Introduction

A Table & Relationship Demonstration

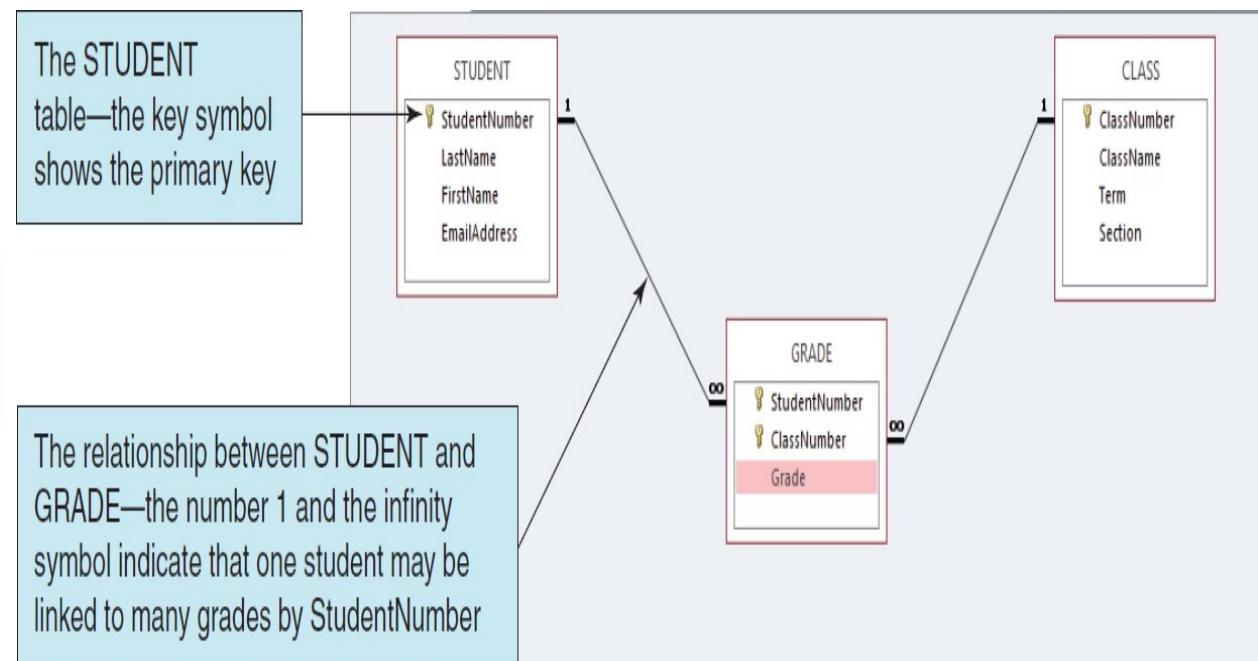
Naming conventions

Table names: all capital letters

- STUDENT, CLASS, GRADE
- COURSE_INFO

Column names: initial capital letter on each word

- Term, Section
- ClassNumber, StudentName



Chapter 1 Introduction

Examples of Database

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.

Chapter 1 Introduction

Database Applications

Basic Functions of Application Programs
Create and process forms
Process user queries
Create and process reports
Execute application logic
Control the application itself

Forms (data entry form):

- To present the data in a format that is useful for the users, regardless of the underlying table structure.

The screenshot shows a Microsoft Access data entry form titled "CLASS". The form contains four text input fields: "Class Number" (40), "Class Name" (ACCT 101), "Term" (2014-Fall), and "Section" (1). Below these fields is a grid titled "CLASS ENROLLMENT DATA" with columns: StudentNumber, LastName, FirstName, and EmailAddress. The grid displays two existing records: "1 Cooke" (Sam, Sam.Cooke@OurU.edu) and "4 Greene" (Grace, Grace.Green@OurU.edu). A new record row is visible at the bottom of the grid, labeled with an asterisk (*) and "(New)". At the bottom of the form, there are navigation buttons for "Record: 14 < 1 of 2 > >> No Filter Search" and a status bar showing "Record: 14 < 4 of 5 > >> No Filter Search".

Database Applications

Basic Functions of Application Programs

Create and process forms

Process user queries

Create and process reports

Execute application logic

Control the application itself

SQL queries:

- The application programs use SQL statements and pass them to DBMS for processing the queries

```
SELECT LastName, FirstName, EmailAddress  
FROM STUDENT  
WHERE StudentNumber > 2;
```

Example SQL Query Results

LastName	FirstName	EmailAddress
Harris	Lou	Lou.Harris@OurU.edu
Greene	Grace	Grace.Greene@OurU.edu
*		

Chapter 1 Introduction

Database Applications

Basic Functions of Application Programs
Create and process forms
Process user queries
Create and process reports
Execute application logic
Control the application itself

Reports:

- The application program formats the query results as a report. The report is structured according to the user's needs, not according to the underlying table structure.

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

Database Applications

Basic Functions of Application Programs
Create and process forms
Process user queries
Create and process reports
Execute application logic
Control the application itself

- Execute Application Logic
 - Decided by the application's business logic not by the database
 - i.e. update inventory
- Control the Application
 1. The application needs to be written so that only logical options are presented to the user.
 - i.e. certain rules about data need to be enforced with the application
 2. The application needs to control data activities with the DBMS
 - i.e. archive historical data

Chapter 1 Introduction

Database Design

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

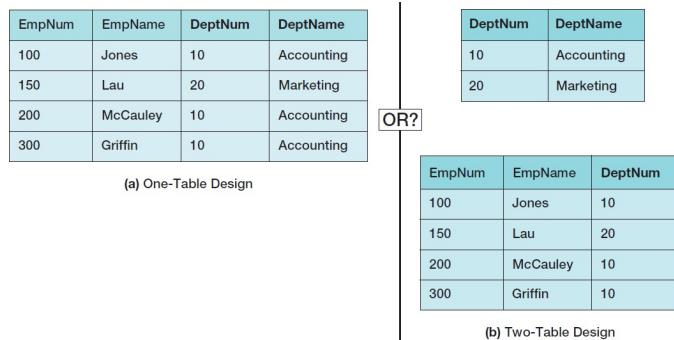
- Database redesign (Chapter 8)

Migrate databases to newer databases

Integrate two or more databases

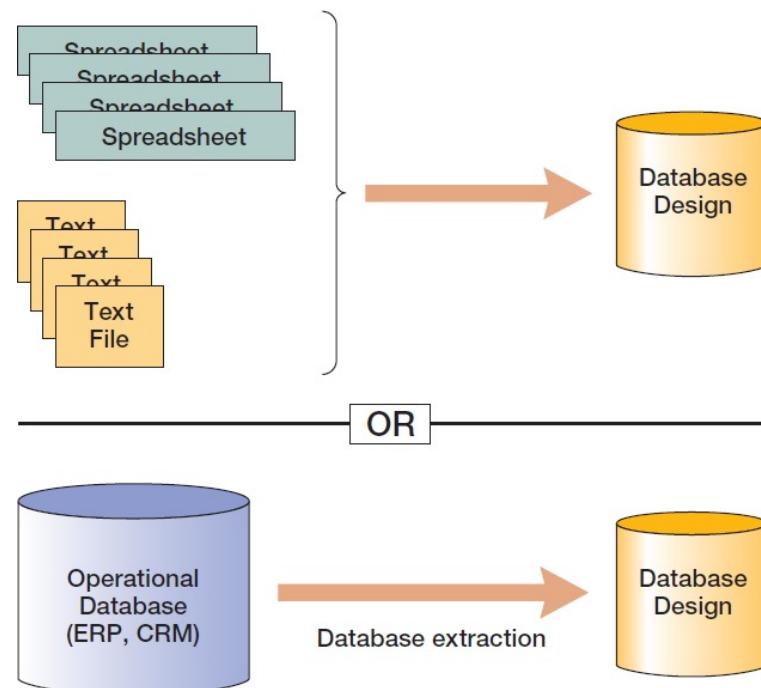
Reverse engineer and design new databases using
normalization principles and data model transformation

Database Design



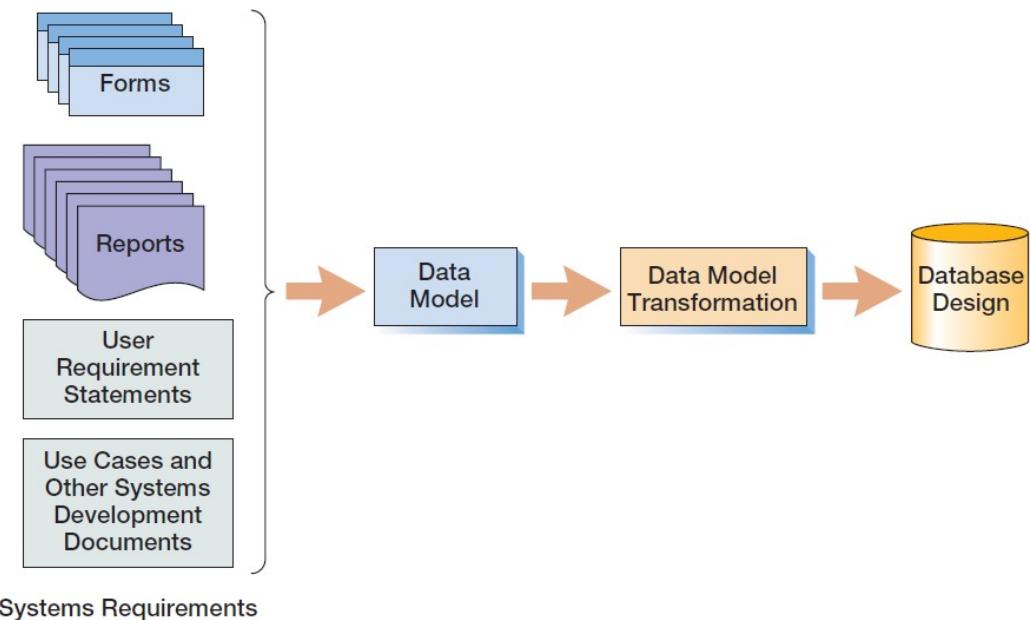
1. Database Design from Existing Data

- Whether to import the data as a single table or two tables?
 - The decision is made based on a set of rules called normalization, which will be covered in Chapter 3



Database Design

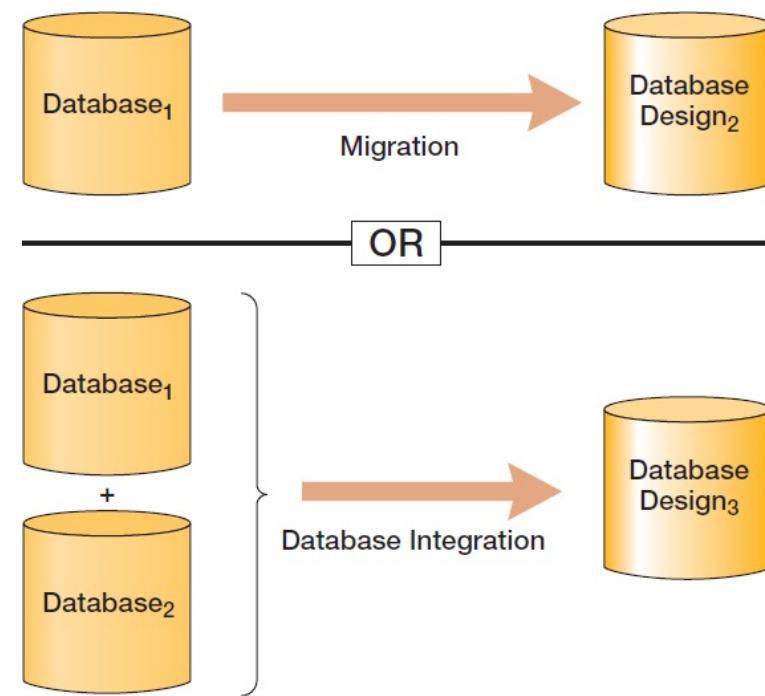
2. Database Design for New System Development
 - Entity-Relationship data modeling is covered in Chapter 5
 - Data model transformations to database designs are covered in Chapter 6



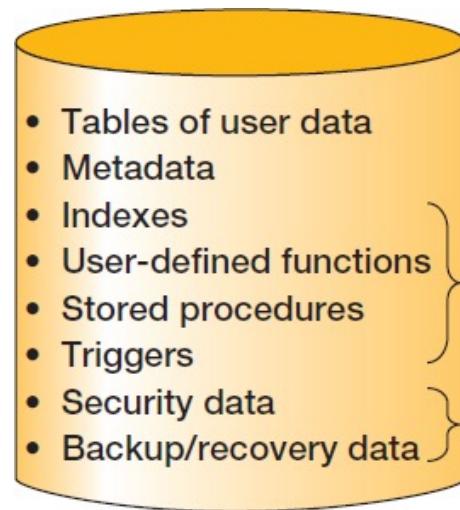
Database Design

3. Database Design for Database Redesign

- SQL in Chapter 7
- Database redesign in Chapter 8



Database Contents



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

Discussed in
Chapters 9, 10, 10A, 10B, 10C

Summary

- Data and databases
- Data in tables
- Relational databases
- Naming conventions
- Components of database systems
- Applications, DBMS and SQL
- Database applications
- The DBMS and database
- Database designs

In-Class Exercise 1

- Restore and backup a database.
- Create a table
- Submit the result to iCollege