

Chapter Ten

# Database Management

**Discovering  
Computers 2012**

**Your Interactive Guide  
to the Digital World**



# Objectives Overview

Define the term, database, and explain how a database interacts with data and information

Define the term, data integrity, and describe the qualities of valuable information

Discuss the terms character, field, record, and file

Describe file maintenance techniques and validation techniques

Differentiate between a file processing approach and the database approach

# Objectives Overview

Discuss the functions common to most database management systems

Describe characteristics of relational, object-oriented, and multidimensional databases

Explain how to access Web databases

Identify database design guidelines and discuss the responsibilities of database analysts and administrators

# Databases, Data, and Information

## Database

- Collection of data organized in a manner that allows access, retrieval, and use of that data

## Data

- Collection of unprocessed items
  - Text
  - Numbers
  - Images
  - Audio
  - Video

## Information

- Processed data
  - Documents
  - Audio
  - Images
  - Video

# Databases, Data, and Information

## How a School's Admissions Department Might Process New Student Data into Information





# Databases, Data, and Information

- Database software, often called a **database management system (DBMS)**, allows users to:

Create a computerized database

Add, modify, and delete data

Sort and retrieve data

Create forms and reports from the data

# Databases, Data, and Information

- ▣ Data integrity identifies the quality of the data
- ▣ Garbage in, garbage out (GIGO) points out the accuracy of a computer's output depends on the accuracy of the input

# Databases, Data, and Information

- ▣ Valuable information should have the following characteristics:

Accurate

Verifiable

Timely

Organized

Accessible

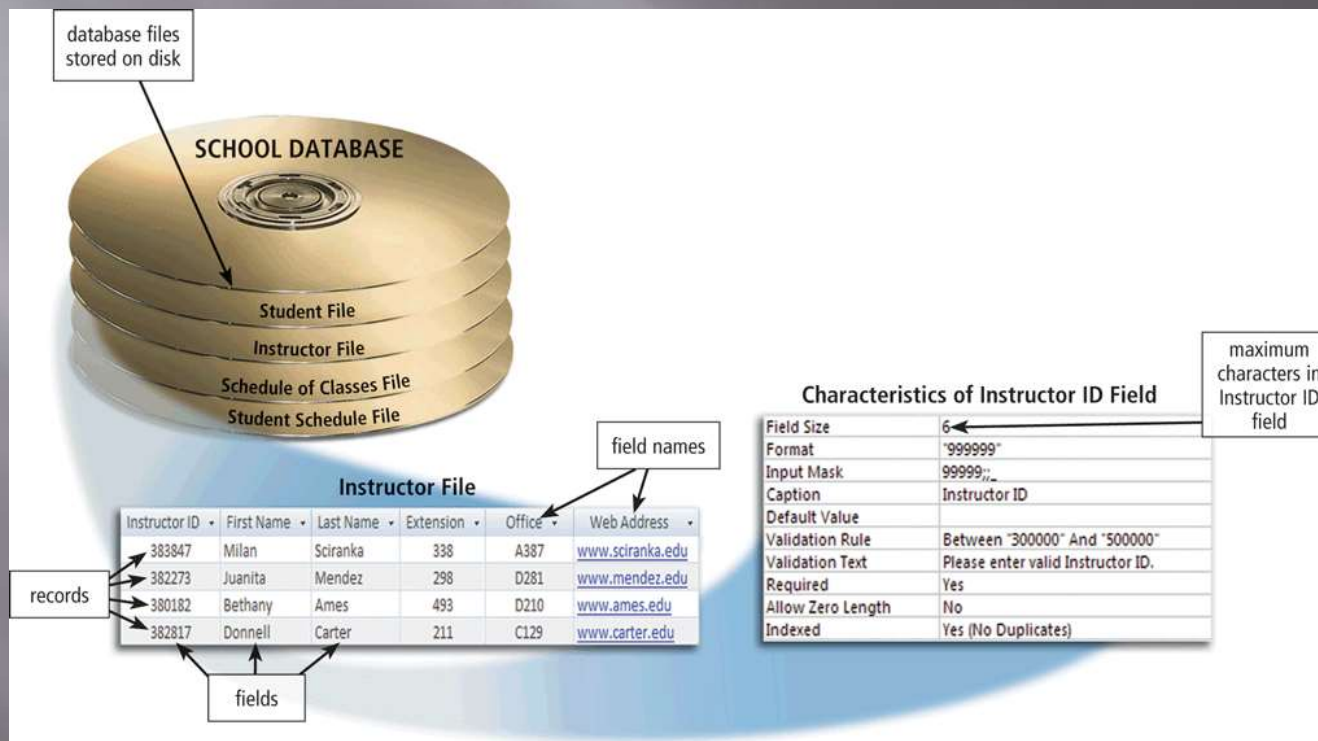
Useful

Cost-  
effective



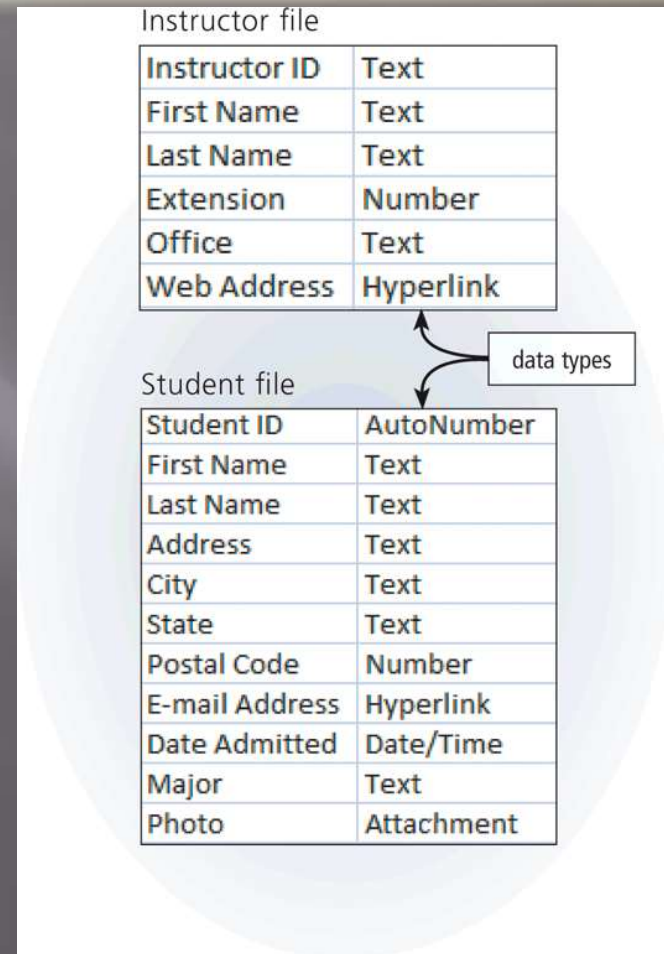
# The Hierarchy of Data

- Data is organized in layers
  - Files, records, fields, characters



# The Hierarchy of Data

- ▣ A **character** is one byte
  - Numbers, letters, space, punctuation marks, or other symbols
- ▣ A **field** is a combination of one or more related characters
  - **Field name**
  - **Field size**
  - **Data type**



# The Hierarchy of Data

- Common data types include:

Text

Numeric

AutoNumber

Currency

Date

Memo

Yes/No

Hyperlink

Object

Attachment

# The Hierarchy of Data

- ▣ A **record** is a group of related fields
  - A **primary key** uniquely identifies each record
- ▣ A **data file** is a collection of related records

Address	City	State	Postal Code	E-mail Address	Date Admitted	Major	Photo
54 Lucy Court	Charlestown	IN	46176		6/10/2010	EE	mbrewer.jpg
33 Timmons Place	Bonner	IN	45208	<a href="mailto:lou@world.com">lou@world.com</a>	8/9/2010	BIO	ldrake.jpg
99 Tenth Street	Sheldon	IN	46033		10/8/2010	CT	aruiz.jpg
2204 Elm Court	Rowley	IN	46167	<a href="mailto:tu@indi.net">tu@indi.net</a>	11/6/2010	GEN	btu.jpg

fields

# Maintaining Data

- ▣ **File maintenance** refers to the procedures that keep data current

Adding  
records

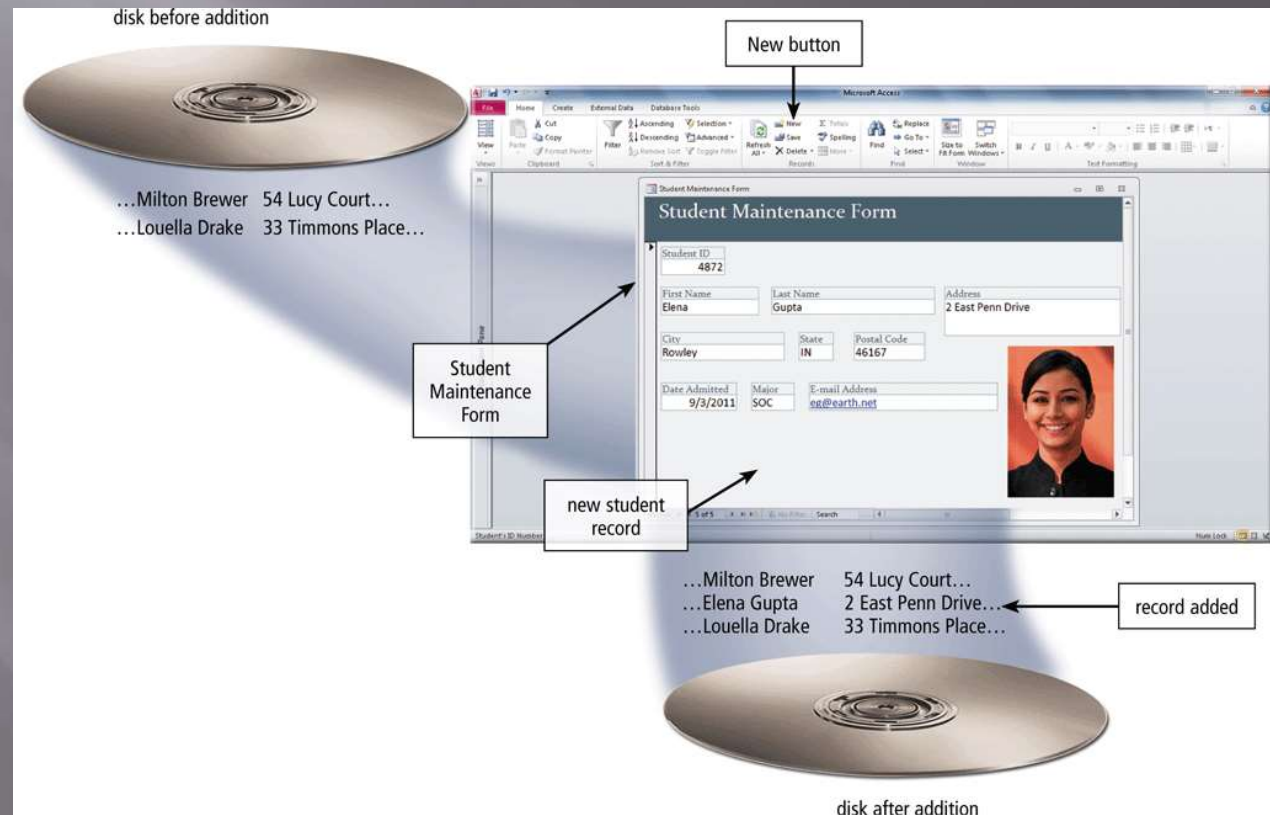
Modifying  
records

Deleting  
records



# Maintaining Data


- Users add new records to a file when they obtain new data



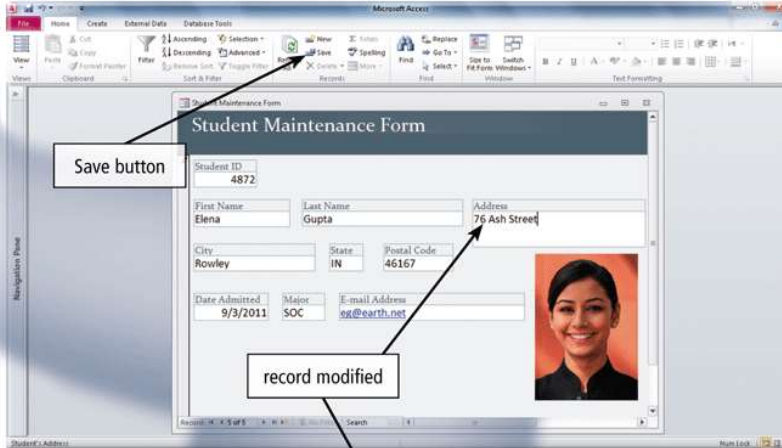
# Maintaining Data

- Users modify a record to correct inaccurate data or update old data

disk before modification




...Milton Brewer 54 Lucy Court...  
...Elena Gupta 2 East Penn Drive...  
...Louella Drake 33 Timmons Place...



Save button

record modified

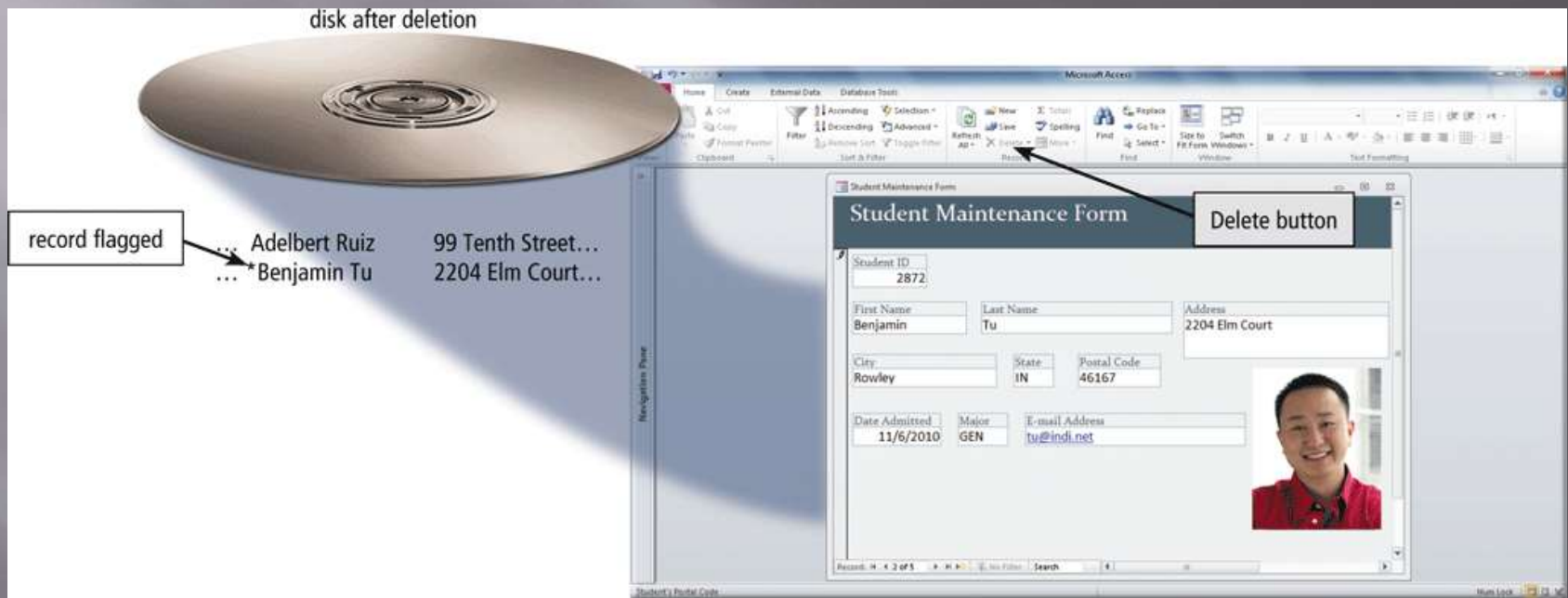
...Milton Brewer 54 Lucy Court...  
...Elena Gupta 76 Ash Street...  
...Louella Drake 33 Timmons Place...



disk after modification

# Maintaining Data

- When a record no longer is needed, a user deletes it from a file



# Maintaining Data

- ▣ **Validation** compares data with a set of rules or values to find out if the data is correct

Alphabetic/Numeric  
check

Range check

Consistency check

Completeness check

Check digit

Other checks

# File Processing Versus Databases

## File processing system

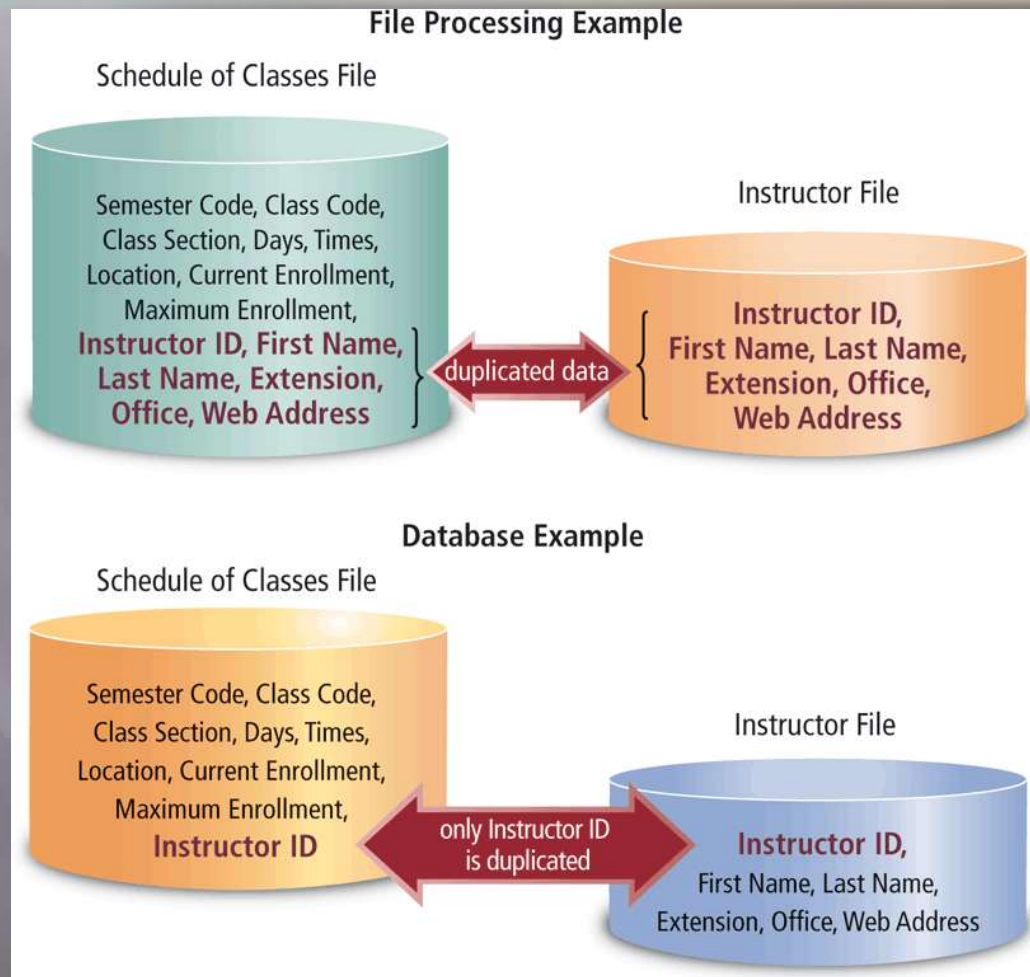
- Each department has its own set of files
- Used for many years
- Have data redundancy
- Isolate data

## Database approach

- Programs and users share data
- Reduce data redundancy
- Improve data integrity
- Share data
- Allows easier access
- Reduces development time
- Can be more vulnerable



# File Processing Versus Databases

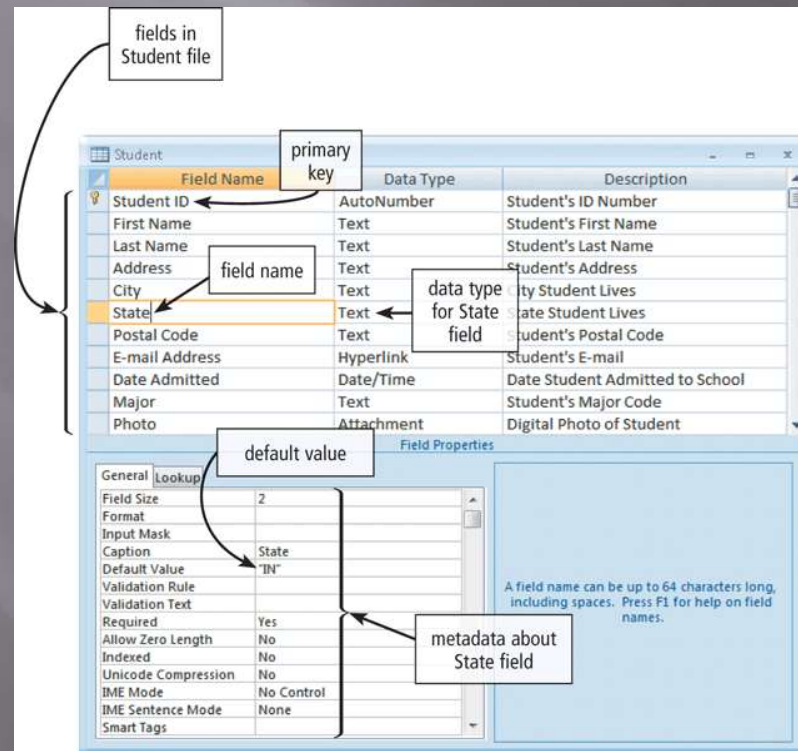


# Database Management Systems

Popular Database Management Systems		
Database	Manufacturer	Computer Type
Access	Microsoft Corporation	Personal computer, server, mobile devices
Adabas	Software AG	Server, mainframe
D <sup>3</sup>	Raining Data	Personal computer, server
DB2	IBM Corporation	Personal computer, server, mainframe
Essbase	Oracle Corporation	Personal computer, server, mobile devices
FastObjects	Versant Corporation	Personal computer, server
FileMaker	FileMaker, Inc.	Personal computer, server
GemFire	GemStone Systems	Server
Informix	IBM Corporation	Personal computer, server, mainframe
Ingres	Ingres Corporation	Personal computer, server, mainframe
InterBaseSMP	Embarcadero Technologies	Personal computer, server
KE Texpress	KE Software, Inc.	Personal computer, server
MySQL	Oracle Corporation	Personal computer, server
ObjectStore	Progress Software Corporation	Personal computer, server
Oracle Database	Oracle Corporation	Personal computer, server, mainframe, mobile devices
SQL Server	Microsoft Corporation	Server, personal computer
SQL Server Compact Edition	Microsoft Corporation	Mobile devices
Sybase	Sybase Inc.	Personal computer, server, mobile devices
Teradata Database	Teradata	Server
Versant	Versant Corporation	Personal computer, server
Visual FoxPro	Microsoft Corporation	Personal computer, server

# Database Management Systems

- ▣ A **data dictionary** contains data about each file in the database and each field in those files



# Database Management Systems

- ▣ A DBMS provides several tools that allow users and programs to retrieve and maintain data in the database

Query language

Query by example

Form

Report generator

# Database Management Systems

- ▣ A **query language** consists of simple, English-like statements that allow users to specify the data to display, print, or store
- ▣ **Query by example (QBE)** provides a GUI to assist users with retrieving data

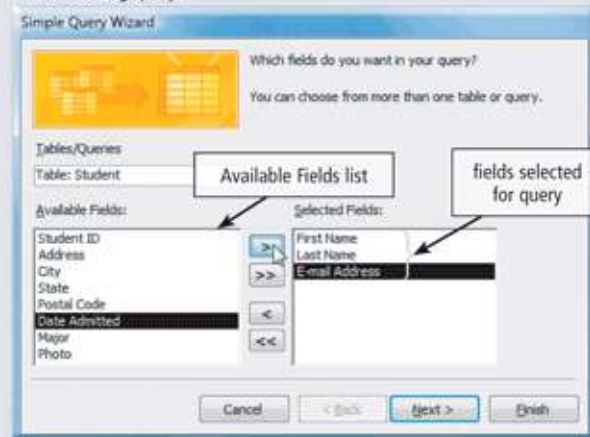


# Database Management Systems

## How to Use the Simple Query Wizard

### Step 1

Select the fields from the Available Fields list you want to be displayed in the resulting query.

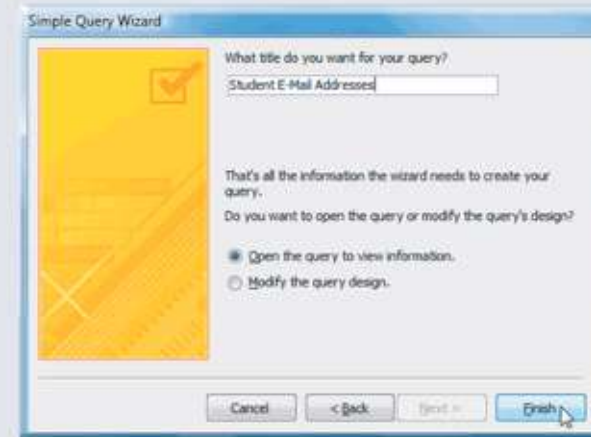


SELECT FIRST NAME, LAST NAME, E-MAIL ADDRESS  
FROM STUDENT

query language  
statement generated  
by wizard

### Step 2

Assign a name to the query, so that you can open it later.



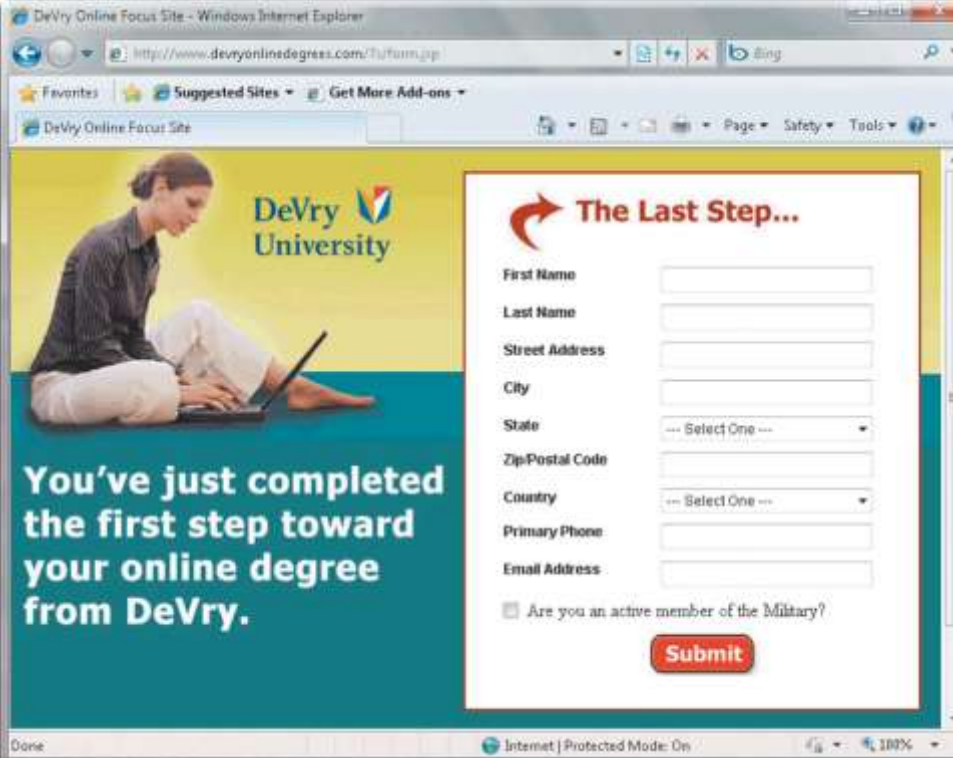
### Step 3

View the query results on the screen.

First Name	Last Name	E-mail Address
Milton	Brewer	
Benjamin	Tu	tu@indi.net
Louella	Drake	lou@world.com
Adelbert	Ruiz	
Elena	Gupta	eg@earth.net

# Database Management Systems

- ▣ A **form** is a window on the screen that provides areas for entering or modifying data in a database



The screenshot shows a web browser window titled "DeVry Online Focus Site - Windows Internet Explorer". The address bar shows the URL "http://www.devryonlinedegrees.com/31/form.asp". The browser's address bar and menu bar are visible. The main content area features a yellow and blue background with the DeVry University logo and a woman sitting on the floor using a laptop. Below the logo, the text reads: "You've just completed the first step toward your online degree from DeVry." To the right of this text is a registration form titled "The Last Step...". The form includes the following fields: First Name, Last Name, Street Address, City, State (a dropdown menu with "-- Select One --"), Zip-Postal Code, Country (a dropdown menu with "-- Select One --"), Primary Phone, and Email Address. At the bottom of the form is a checkbox labeled "Are you an active member of the Military?" and a red "Submit" button. The browser's status bar at the bottom shows "Done", "Internet | Protected Mode: On", and "100%".

# Database Management Systems

- A **report generator** allows users to design a report on the screen, retrieve data into the report design, and then display or print the report

Student List by Major						
Major	Last Name	Student ID	First Name	Address	City	Date Admitted
<b>BIO</b>						
	Drake	3876	Louella	33 Timmons Place	Bonner	8/9/2010
<b>CT</b>						
	Ruiz	3928	Adelbert	99 Tenth Street	Sheldon	10/8/2010
<b>GEN</b>						
	Tu	2928	Benjamin	2204 Elm Court	Rowley	9/4/2010
<b>SOC</b>						
	Brewer	2295	Milton	54 Lucy Court	Charleston	6/10/2010
	Gupta	4872	Elena	76 Ash Street	Rowley	9/3/2011

# Database Management Systems

A DBMS provides means to ensure that only authorized users access data at permitted times

- Access privileges
- Principle of least privilege

# Database Management Systems

- ▣ A DMBS provides a variety of techniques to restore the database to a usable form in case it is damaged or destroyed

**Backup**

**Log**

**Recovery  
utility**

**Continuous  
backup**



# Database Management Systems

Student ID		
4872		
First Name	Last Name	Address
Elena	Gupta	2 East Penn Drive
City	State	Postal Code
Rowley	IN	46167
Date Admitted	Major	E-mail Address
9/3/2011	SOC	eg@earth.net



Address
76 Ash Street

Student ID		
4872		
First Name	Last Name	Address
Elena	Gupta	76 Ash Street
City	State	Postal Code
Rowley	IN	46167
Date Admitted	Major	E-mail Address
9/3/2011	SOC	eg@earth.net



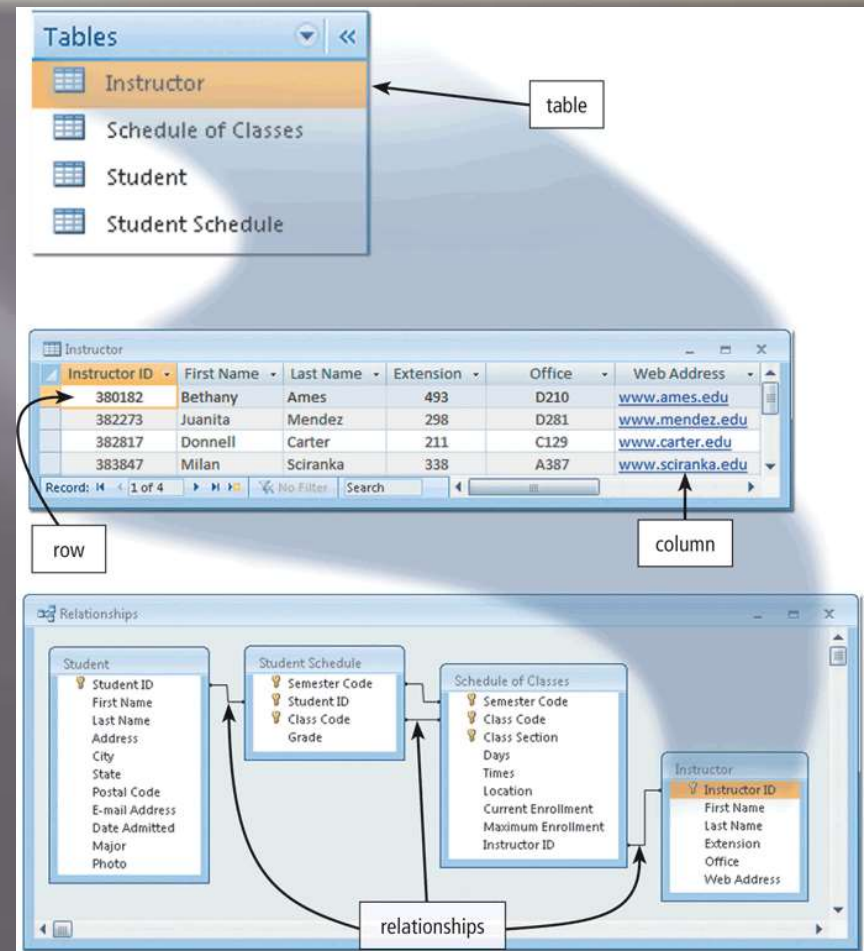
# Relational, Object-Oriented, and Multidimensional Databases

- ▣ A **data model** consists of rules and standards that define how the database organizes data

Data Models for Popular DBMSs					
Data Model	Popular DBMSs		Data Model	Popular DBMSs	
Relational	Access	SQL Server	Object-relational	DB2	
	Adabas	Sybase		Oracle	
	FileMaker	Teradata		Polyhedra	
	Informix			PostgreSQL	
	Ingres			Visual FoxPro	
	InterBase			Teradata	
	MySQL				
Object-oriented	FastObjects	ObjectStore	Multi-dimensional	D <sup>3</sup>	Oracle Express
	GemFire	Versant		Essbase	Edition
	KE Texpress				

# Relational, Object-Oriented, and Multidimensional Databases

- A **relational database** stores data in **tables** that consist of rows and columns
  - Each **row** has a primary key
  - Each **column** has a unique name
- A **relationship** is a link within the data



# Relational, Object-Oriented, and Multidimensional Databases

- ▣ **Structured Query Language (SQL)** is a query language that allows users to manage, update, and retrieve data

```
SELECT CLASS_TITLE, CLASS_CODE, MAXIMUM_ENROLLMENT -  
    CURRENT_ENROLLMENT AS SEATS_REMAINING  
FROM SCHEDULE_OF_CLASSES, CLASS_CATALOG  
WHERE SCHEDULE_OF_CLASSES.CLASS_CODE =  
    CLASS_CATALOG.CLASS_CODE  
ORDER BY CLASS_TITLE
```

Class Title	Class Section	Seats Remaining
Algebra 1	51	14
Art Appreciation	52	19
English Composition 1	02	5
Introduction to Sociology	01	14



# Relational, Object-Oriented, and Multidimensional Databases

- ▣ An **object-oriented database (OODB)** stores data in **objects**
- ▣ Examples of applications appropriate for an object-oriented database include:

Multimedia  
database

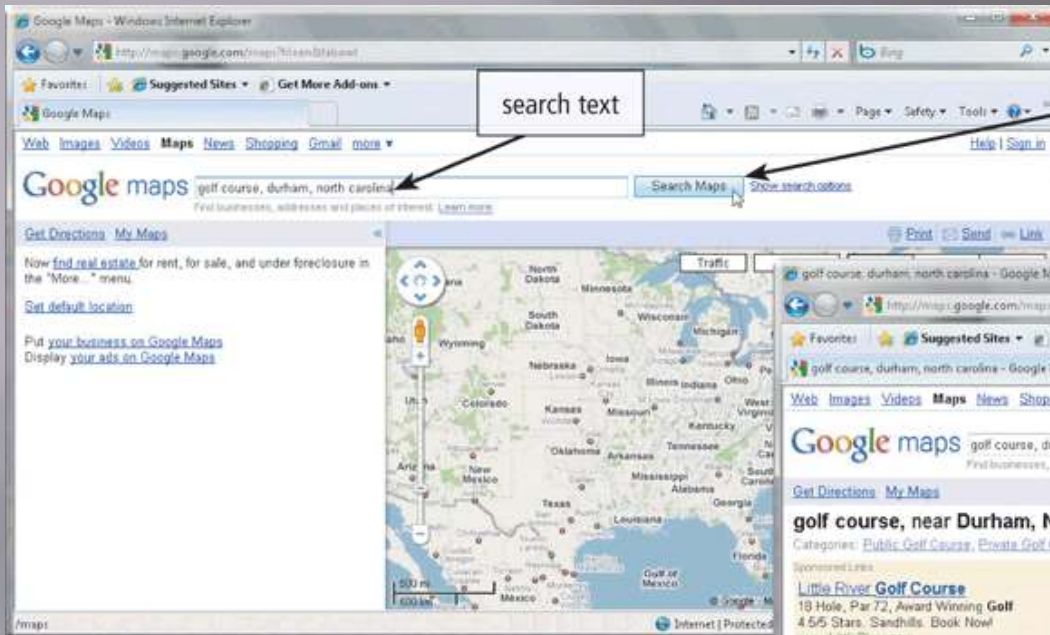
Groupware  
database

Computer-  
aided design  
database

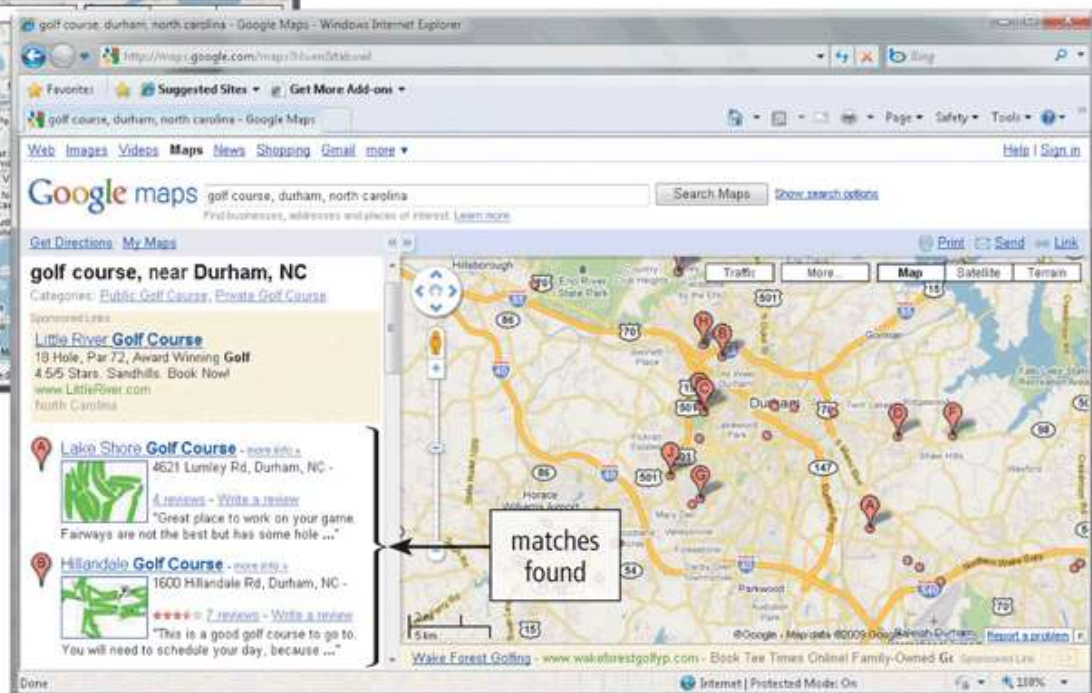
Hypertext  
database



# Relational, Object-Oriented, and Multidimensional Databases



Search Maps button causes Google Maps database to be searched



# Relational, Object-Oriented, and Multidimensional Databases

- ▣ A **multidimensional database** can store data in more than two dimensions of data
  - Sometimes known as a hypercube
  - Can consolidate data much faster than a relational database
- ▣ A **data warehouse** is a huge database that stores and manages the data required to analyze historical and current transactions

# Web Databases

- ▣ Databases on the Web allow you to:

Shop for  
products or  
services

Buy or sell  
stocks

Search for a job

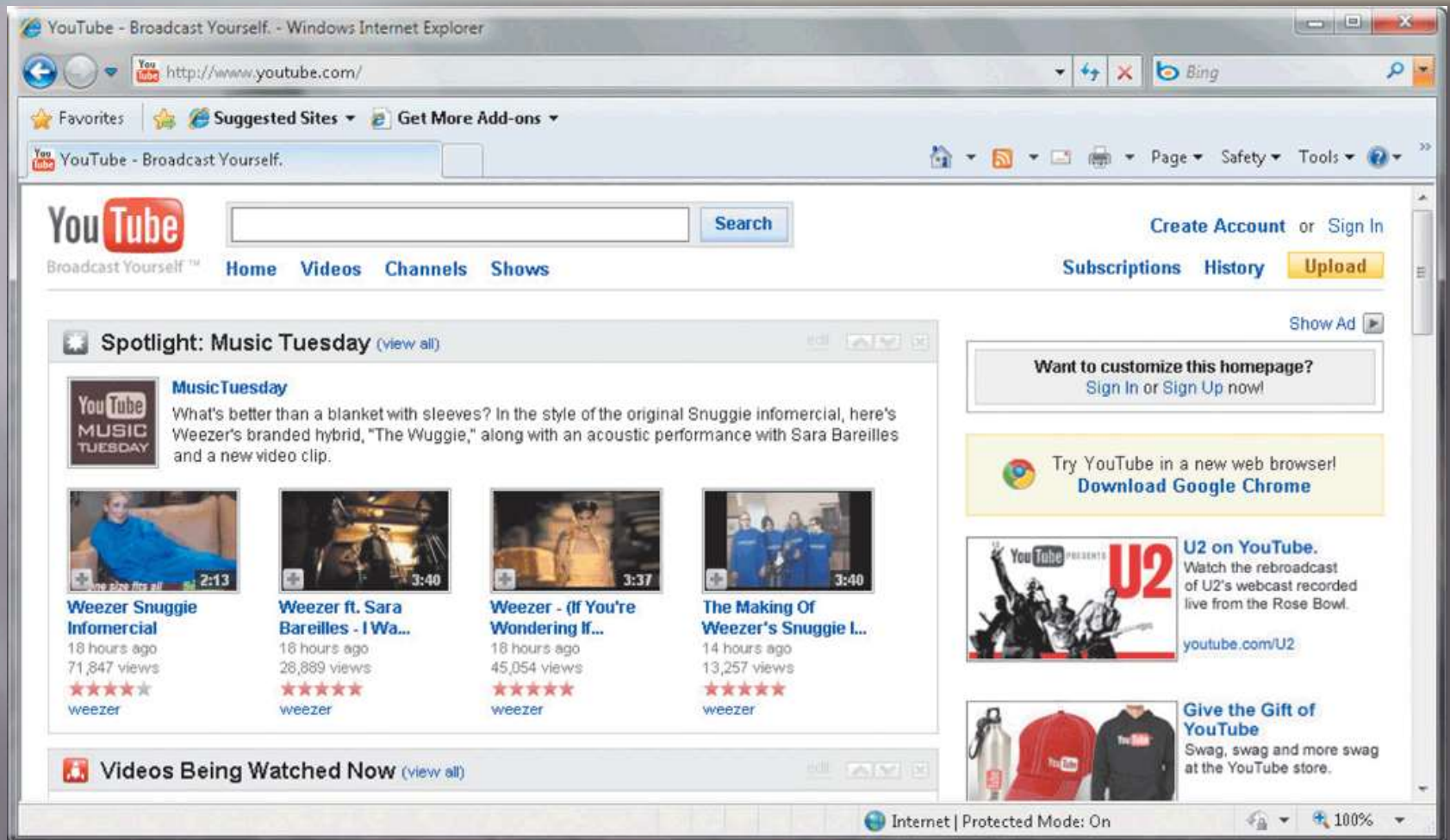
Make airline  
reservations

Register for  
college classes

Check semester  
grades



# Web Databases



# Database Administration

- ▣ It is important to have a carefully designed database

## Database Design Guidelines

1. Determine the purpose of the database.
2. Design the tables or files.
  - Design tables or files on paper first.
  - Each table or file should contain data about one subject. The Student table, for example, contains data about students.
3. Design the records and fields for each table or file.
  - Be sure every record has a unique primary key.
  - Use separate fields for logically distinct items. For example, a name could be stored in six fields: Title (Mr., Mrs., Dr., etc.), First Name, Middle Name, Last Name, Suffix (Jr., Sr., etc.), and Nickname.
  - Do not create fields for information that can be derived from entries in other fields. For example, do not include a field for Age. Instead, store the birth date and compute the age.
  - Allow enough space for each field.
  - Set default values for frequently entered data.
4. Determine the relationships among the tables or files.



# Database Administration

Database analysts and administrators are responsible for managing and coordinating all database activities

## **Database Analyst (DA)**

Decides on proper field placement, defines data relationship, and identifies users' access privileges

## **Database Administrator (DBA)**

Creates and maintains the data dictionary, manages security, monitors performance, and checks backup and recovery procedures

# Database Administration

- ▣ Employees should learn how to use the data in the database effectively
  - Interact with database
  - Identify new data for the database
  - Maintain the database



# Summary

How data and information are valuable assets to an organization

Methods for maintaining high-quality data

Assessing the quality of valuable information

Advantages of organizing data in a database

Various types of databases

Roles of the database analysts and administrators

Chapter Ten

# Database Management

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**Chapter 10 Complete**

