Database Management

Discovering Computers 2012

Your Interactive Guide to the Digital World
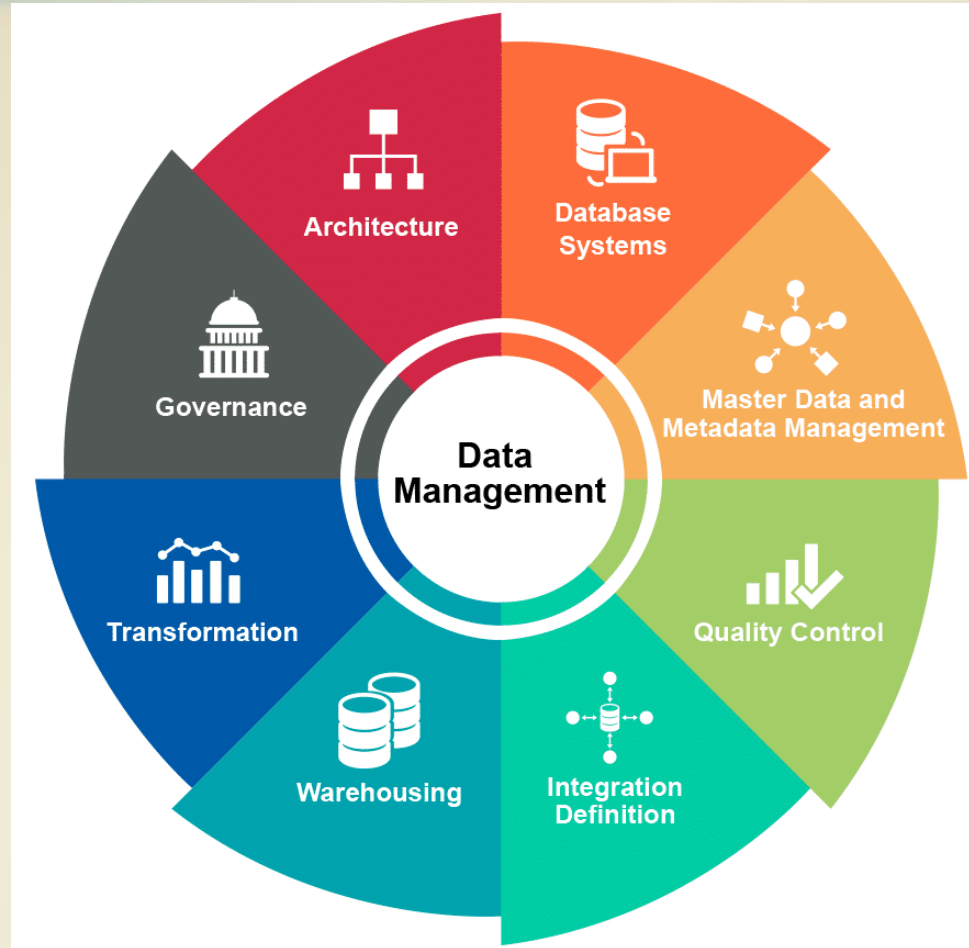
Objectives Overview

Related terms: data integrity, value, field, record, and table

Database maintenance: adding, modifying, deleting

Database Management System: query, form, report, privilege, backup and recovery

Database models: hierarchical, network, relational, object-oriented

Databases Management

Databases Management, Reasons?

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Databases Management, Reasons?

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Databases, Data, and Information

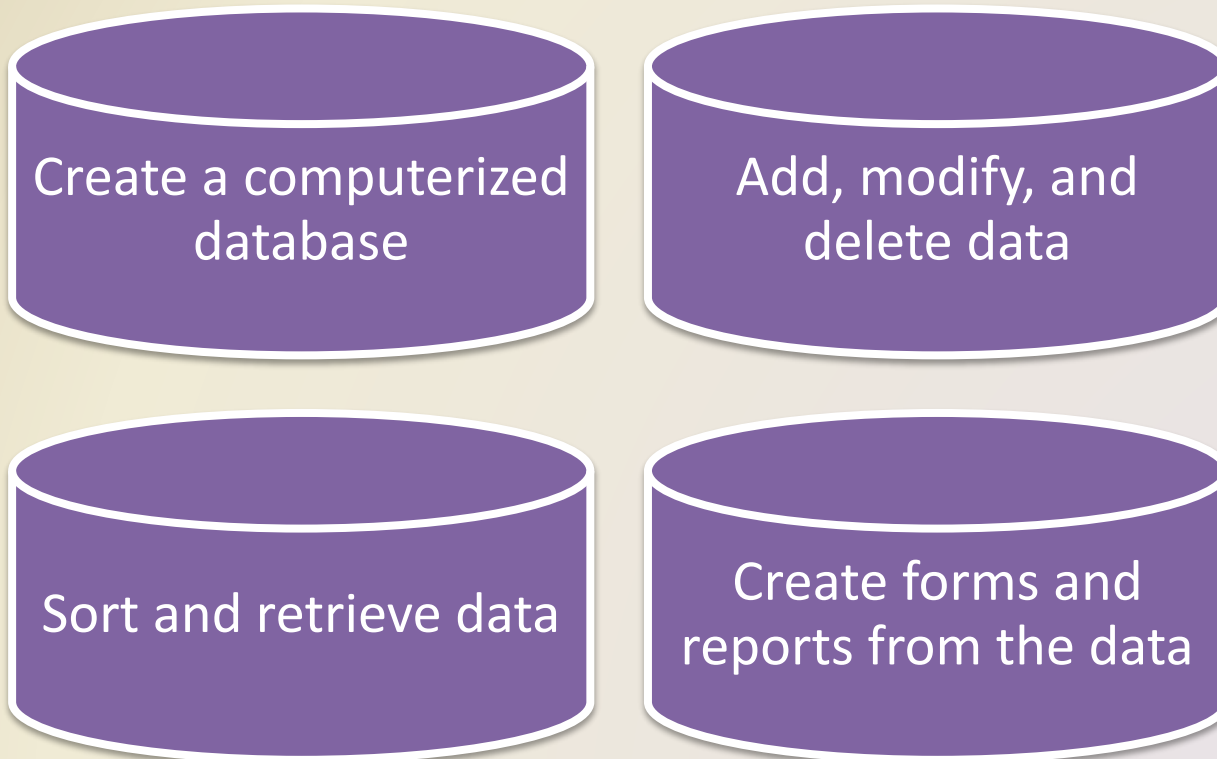| Database	Data	Information

• Collection of *data organized* in a manner that allows *access, retrieval*, and **share** that data	• Collection of *unprocessed items*
	  • Text
	  • Numbers
	  • Images
	  • Audio
	  • Video
		• *Processed data*
		  • Documents
		  • Audio
		  • Images
		  • Video

Databases, Data, and 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

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

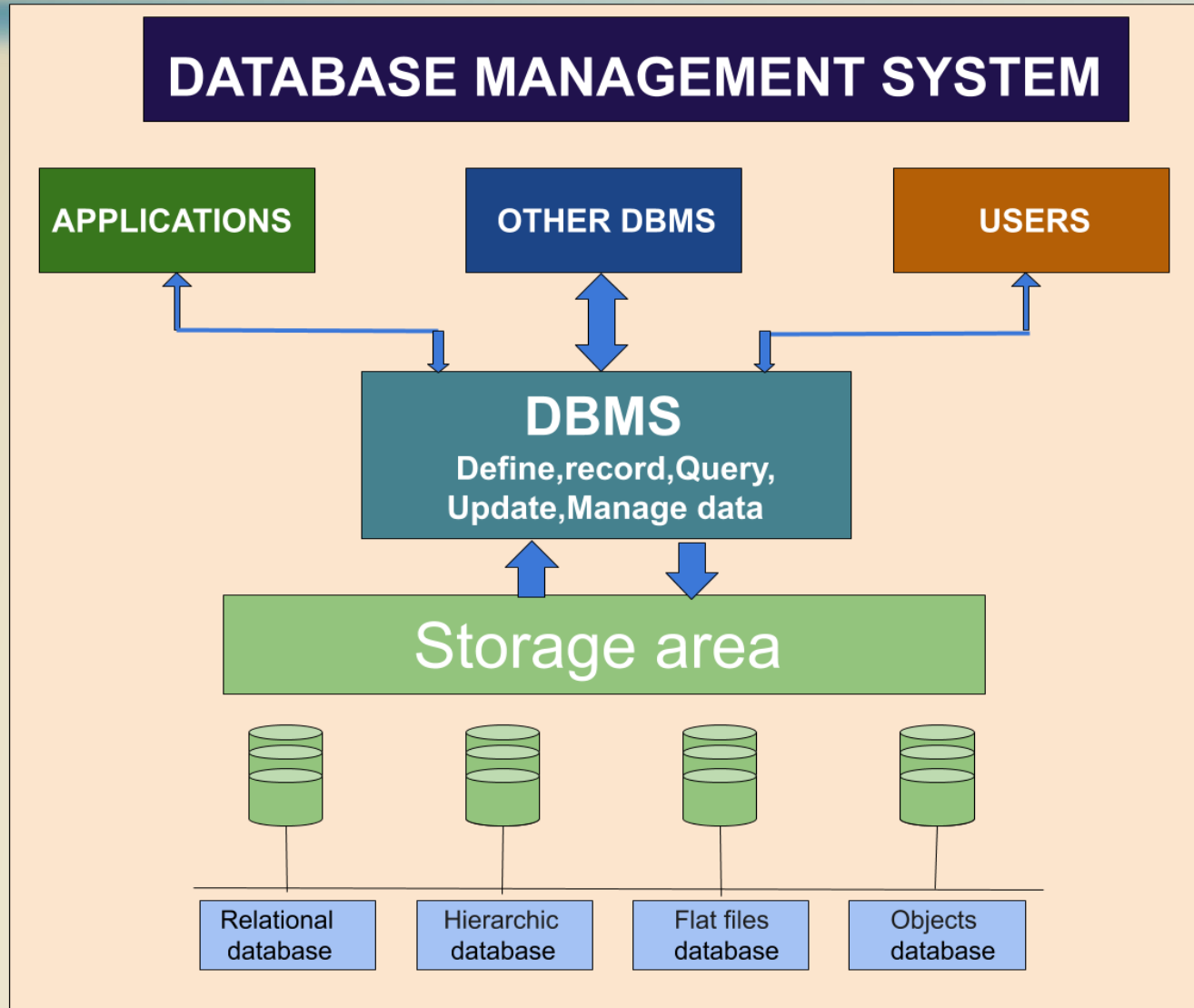Discovering Computers 2012: Chapter 10

Database management system

DATABASE MANAGEMENT SYSTEM

APPLICATIONS | OTHER DBMS | USERS

DBMS
Define, record, Query,
Update, Manage data

Storage area

| Relational database | Hierarchic database | Flat files database | Objects database |

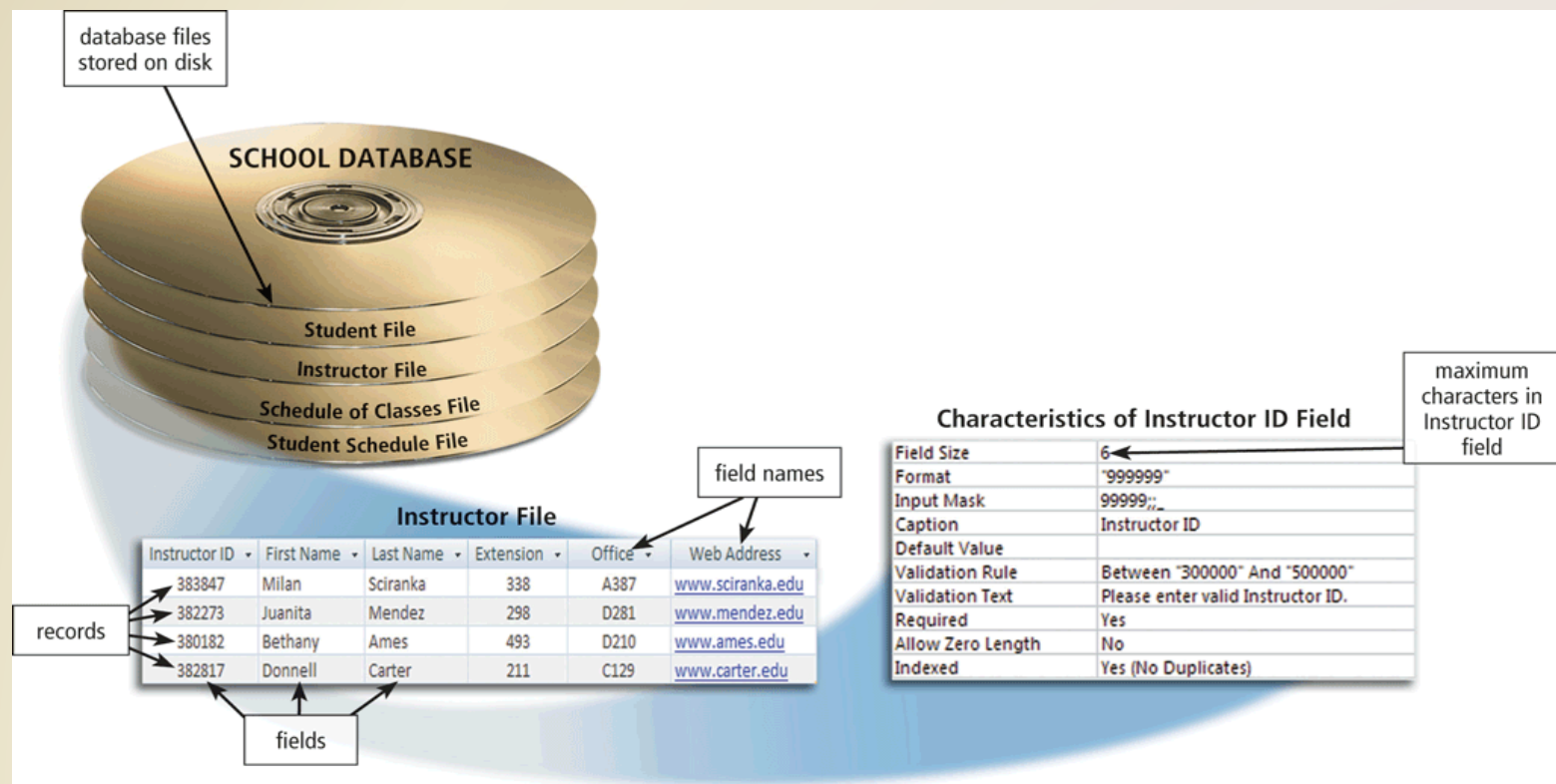Discovering Computers 2012: Chapter 10

Databases, Data, and Information

- ***Data integrity***
  - o identifies the quality of the data
  - o data are *intact and unchanged* when being stored or transmitted.
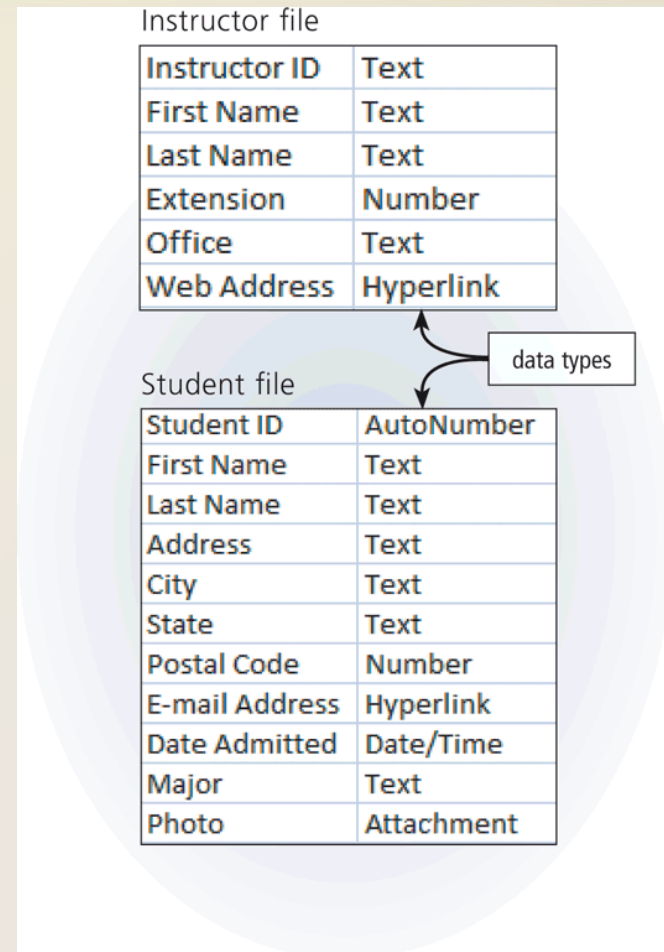
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The Hierarchy of Data

- Data is organized in layers
  - Tables, records, fields, values

The Hierarchy of Data

- A **value** is one data cell
  - Numbers, letters, space, punctuation marks, or other symbols
- A **field** is a combination of one or more related values
  - **Field name**
  - **Field size**
  - **Data type**

Instructor file

Instructor ID	Text
First Name	Text
Last Name	Text
Extension	Number
Office	Text
Web Address	Hyperlink

data types

Student file

Student ID	AutoNumber
First Name	Text
Last Name	Text
Address	Text
City	Text
State	Text
Postal Code	Number
E-mail Address	Hyperlink
Date Admitted	Date/Time
Major	Text
Photo	Attachment

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 table** 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	lou@world.com	8/9/2010	BIO	ldrake.jpg
99 Tenth Street	Sheldon	IN	46033		10/8/2010	CT	aruiz.jpg
2204 Elm Court	Rowley	IN	46167	tu@indi.net	11/6/2010	GEN	btu.jpg

fields

Database Manipulation

- **Database manipulation** refers to the actions that take affect to current data

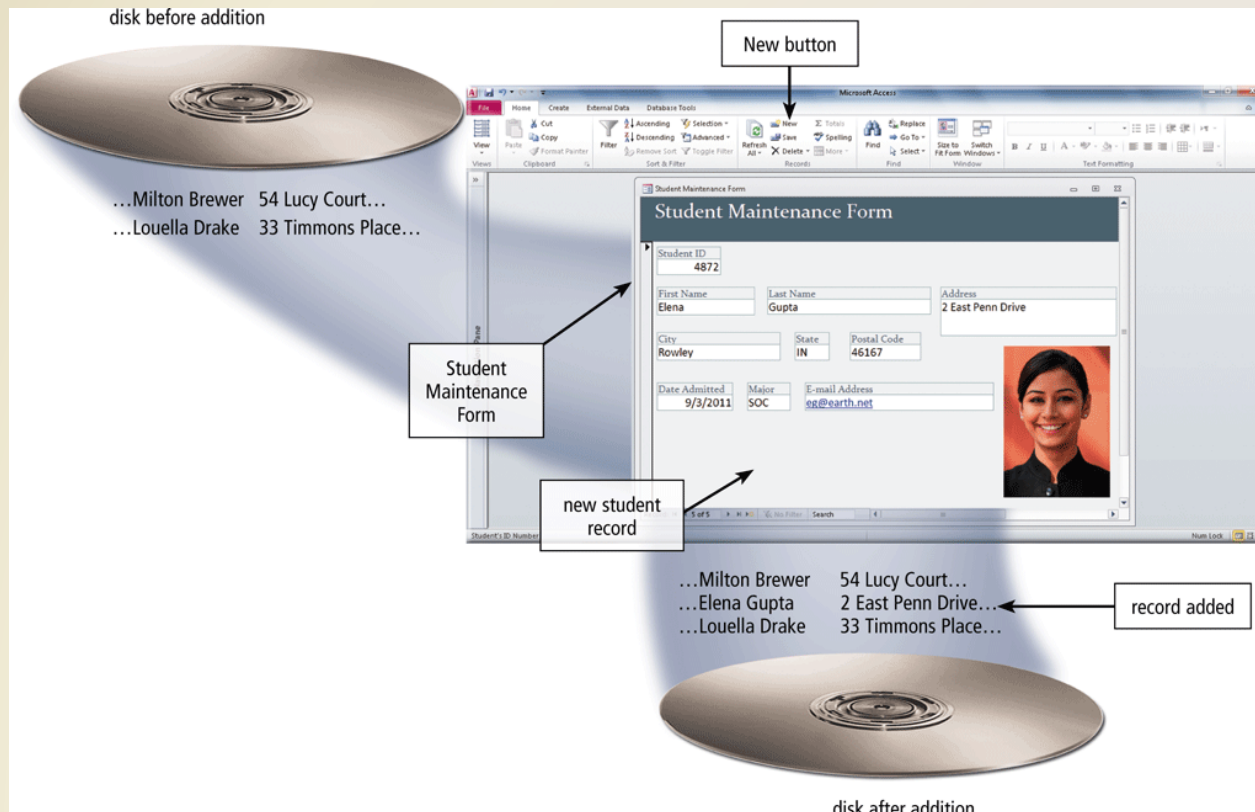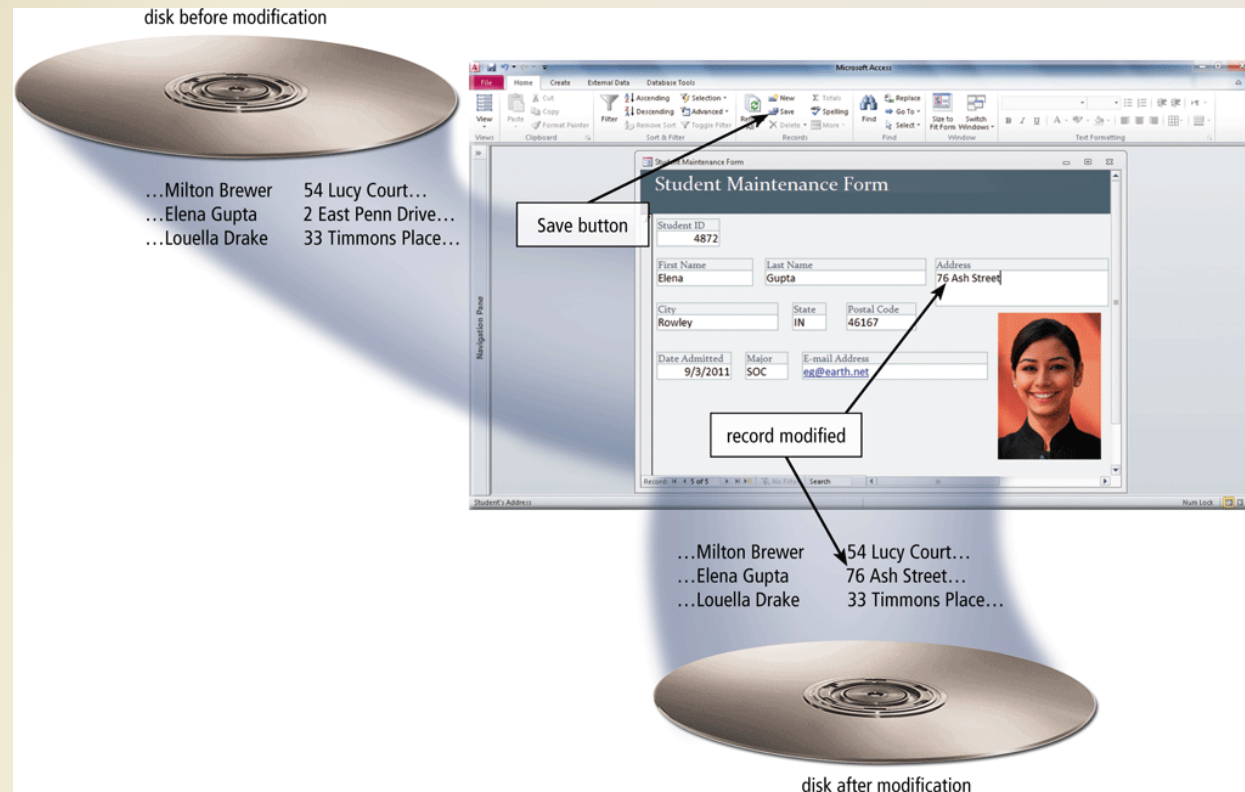Adding records

Modifying records

Deleting records

Database Manipulation

- Users add new records to a table when they obtain new data
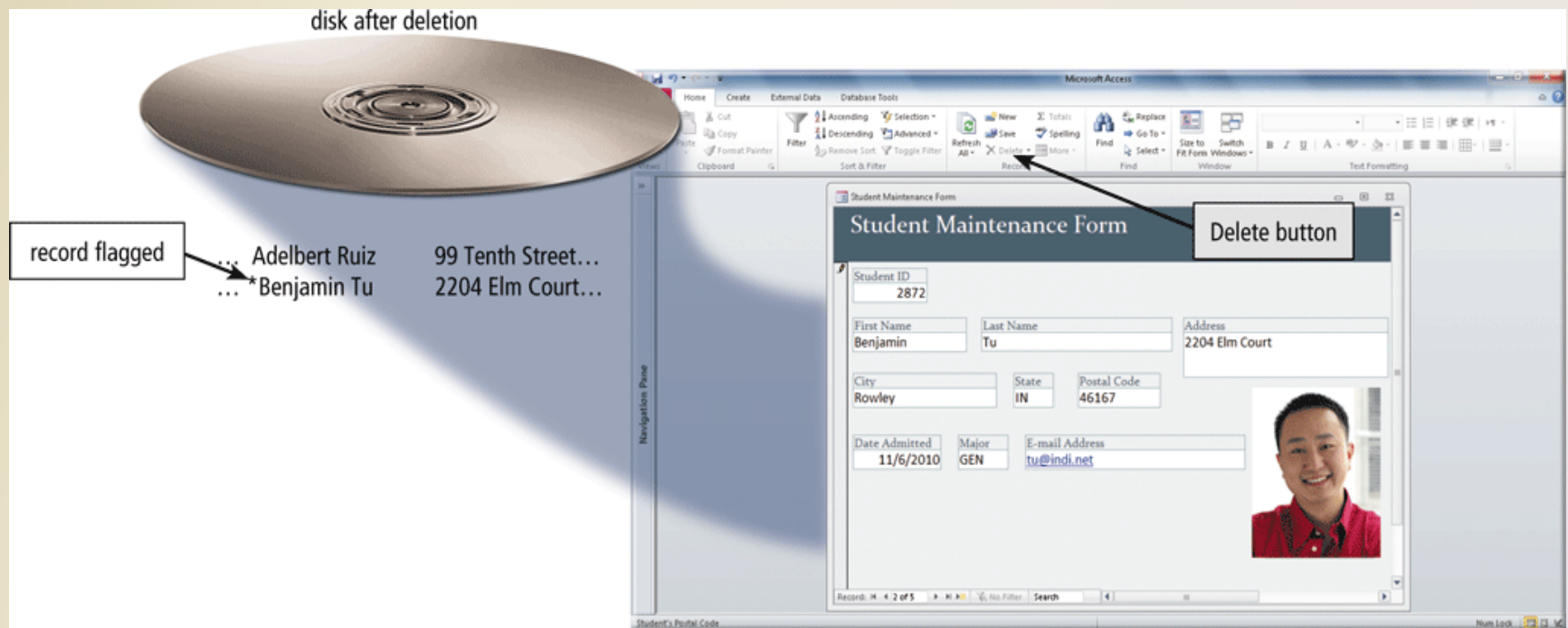
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18

Database Manipulation

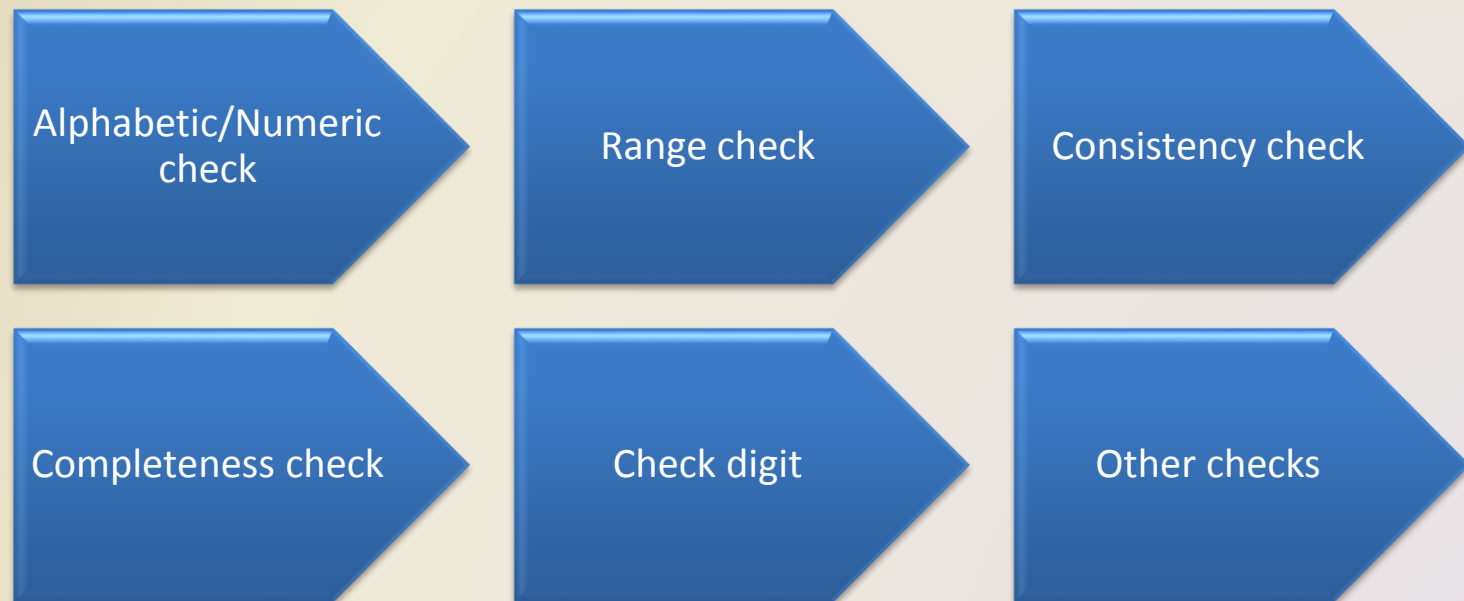- Users modify a record to correct inaccurate data or update old data

Database Manipulation

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

Database Manipulation

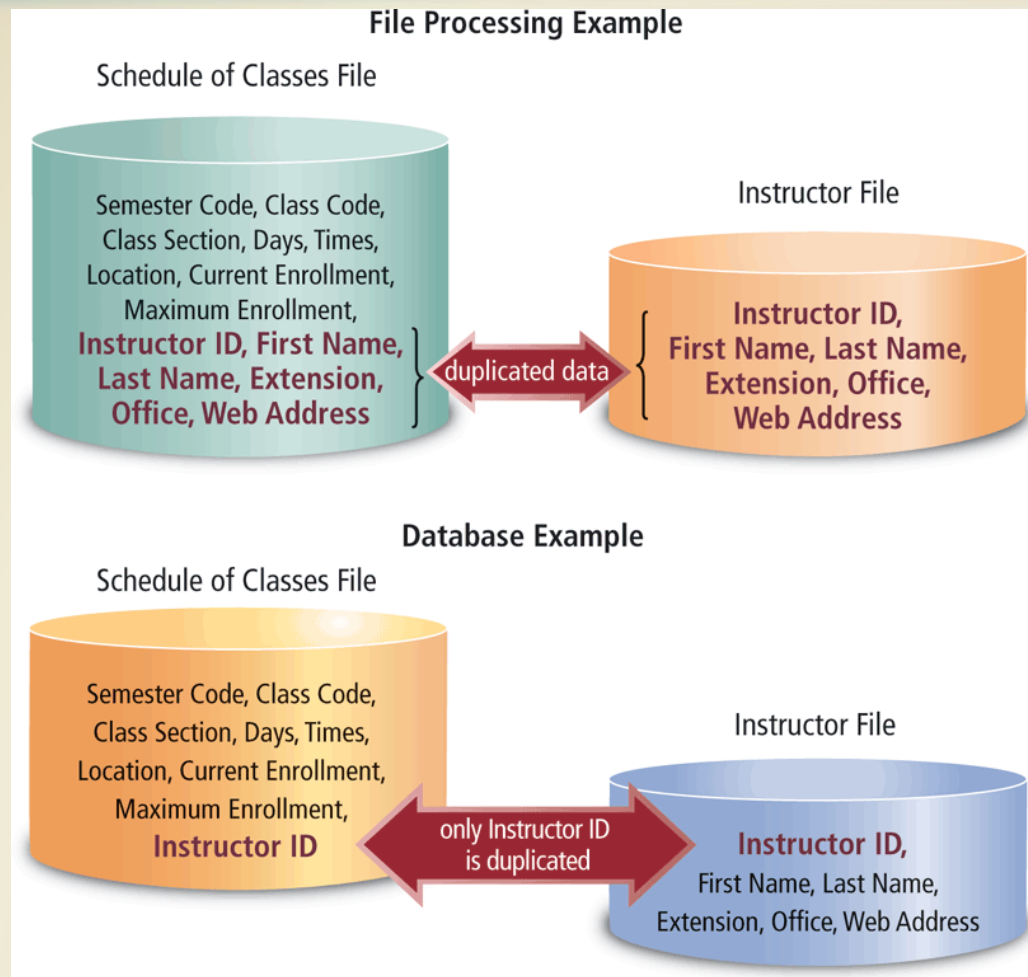- **Validation** compares data with a set of rules or values to find out if the data is correct

| Alphabetic/Numeric check | Range check | Consistency check |
| Completeness check | Check digit | Other checks |

Flat File Versus Databases

Flat File system	Database approach
• Put all information in "one large table" • OK for small database. • Used for many years • Have data redundancy • Isolate data	• Programs and users share data • Reduce data redundancy • Improve data integrity • Share data • Allows easier access • Reduces development time • Can be more vulnerable

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File Processing Versus Databases

File Processing Example

Schedule of Classes File

Semester Code, Class Code, Class Section, Days, Times, Location, Current Enrollment, Maximum Enrollment, **Instructor ID, First Name, Last Name, Extension, Office, Web Address**

duplicated data

Instructor File

Instructor ID, First Name, Last Name, Extension, Office, Web Address

Database Example

Schedule of Classes File

Semester Code, Class Code, Class Section, Days, Times, Location, Current Enrollment, Maximum Enrollment, **Instructor ID**

only Instructor ID is duplicated

Instructor File

Instructor ID, First Name, Last Name, Extension, Office, Web Address

Database Management Systems

- Most popular DBMS in 2016 by *db-engines.com*

Rank		DBMS	Database Model
Aug 2016	Sep 2015		
1.	1.	Oracle	Relational DBMS
2.	2.	MySQL ➕	Relational DBMS
3.	3.	Microsoft SQL Server	Relational DBMS
↑ 5.	↑ 5.	PostgreSQL	Relational DBMS
↓ 4.	↓ 4.	MongoDB ➕	Document store
6.	6.	DB2	Relational DBMS
7.	↑ 8.	Cassandra ➕	Wide column store
8.	↓ 7.	Microsoft Access	Relational DBMS
9.	9.	SQLite	Relational DBMS
10.	10.	Redis	Key-value store

Database Management Systems

- ## Some DBMS over 3 years by *db-engines.com*

DB-Engines Ranking

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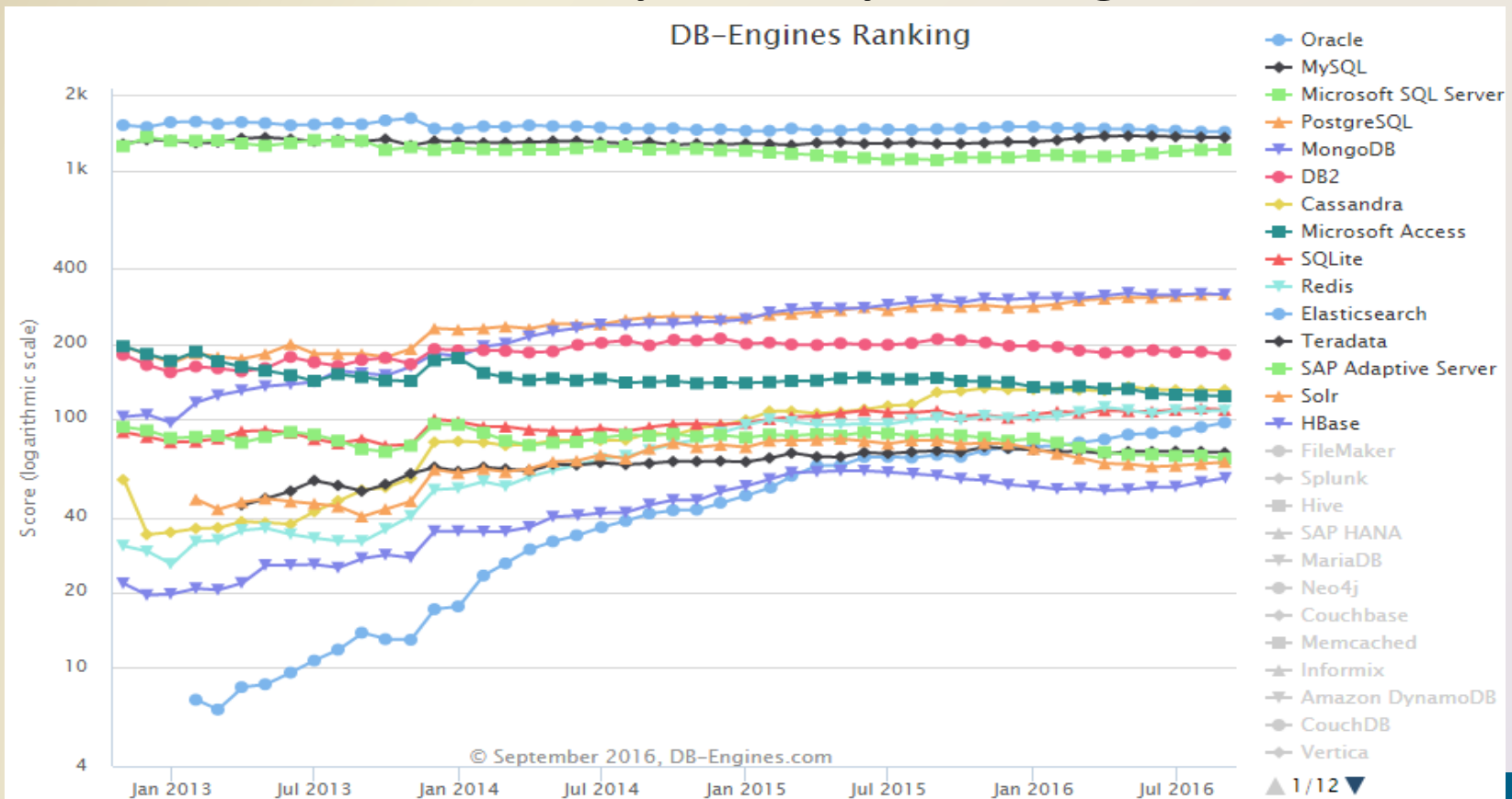
Database Management Systems

- A **data dictionary** is a collection of *descriptions* of the data objects in a database.
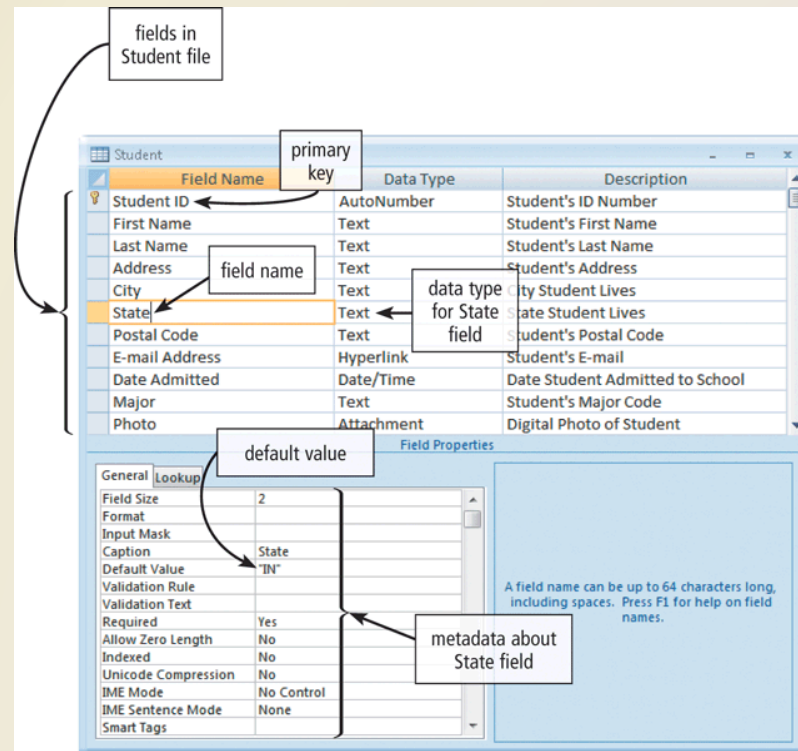
Database Management Systems

- 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
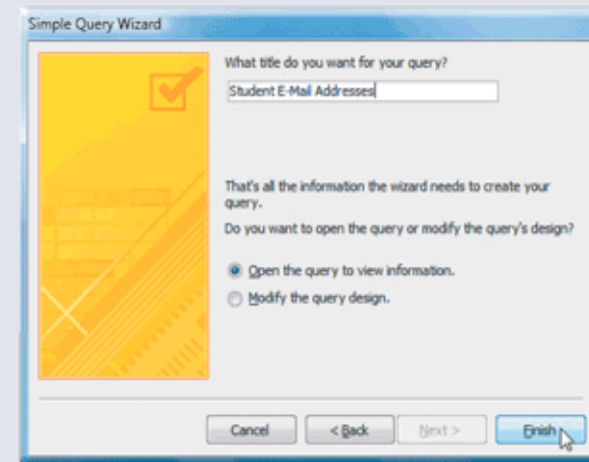

How to Use the Simple Query Wizard

Step 1
Select the fields from the Available Fields list you want to be displayed in the resulting query.
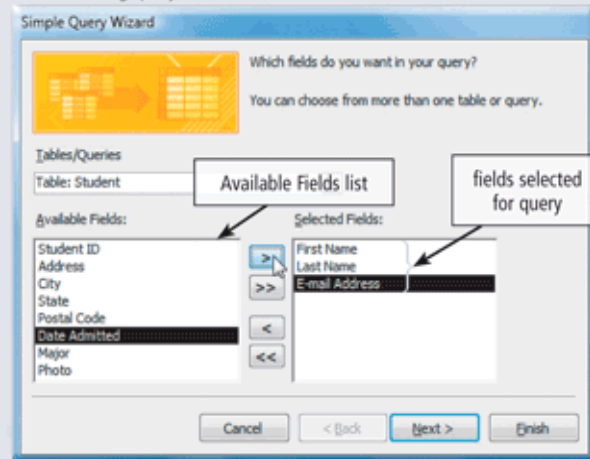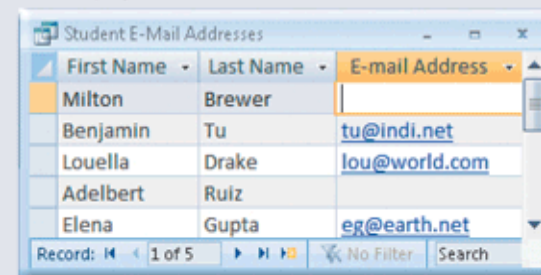
Step 2
Assign a name to the query, so that you can open it later.

Step 3
View the query results on the screen.

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

query language statement generated by wizard

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

Database Management Systems

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

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
BIO						
	Drake	3876	Louella	33 Timmons Place	Bonner	8/9/2010
CT						
	Ruiz	3928	Adelbert	99 Tenth Street	Sheldon	10/8/2010
GEN						
	Tu	2928	Benjamin	2204 Elm Court	Rowley	9/4/2010
SOC						
	Brewer	2295	Milton	54 Lucy Court	Charlestown	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
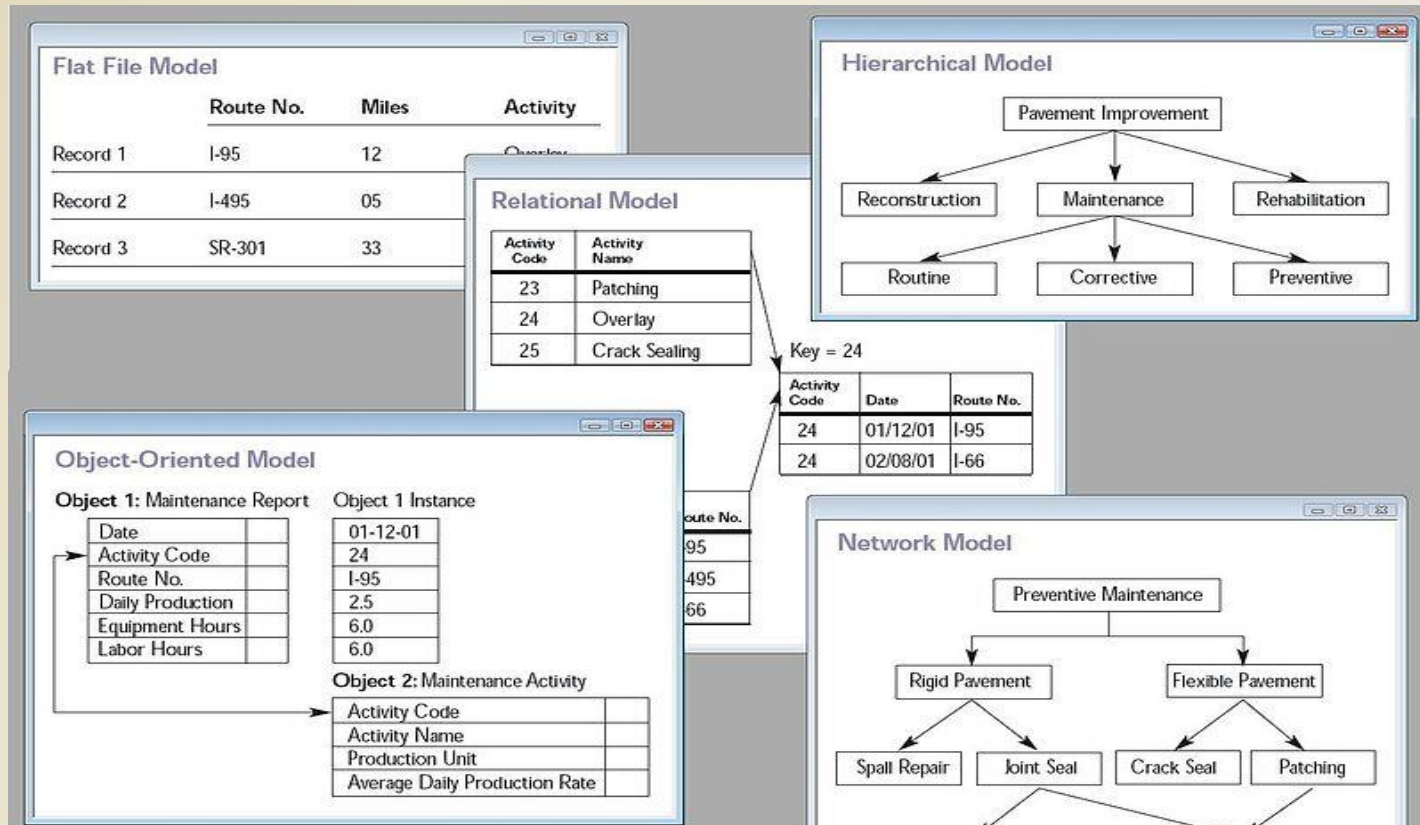
| Backup	Log
Recovery utility	Continuous backup

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Relational, Object-Oriented, and Multidimensional Databases

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

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
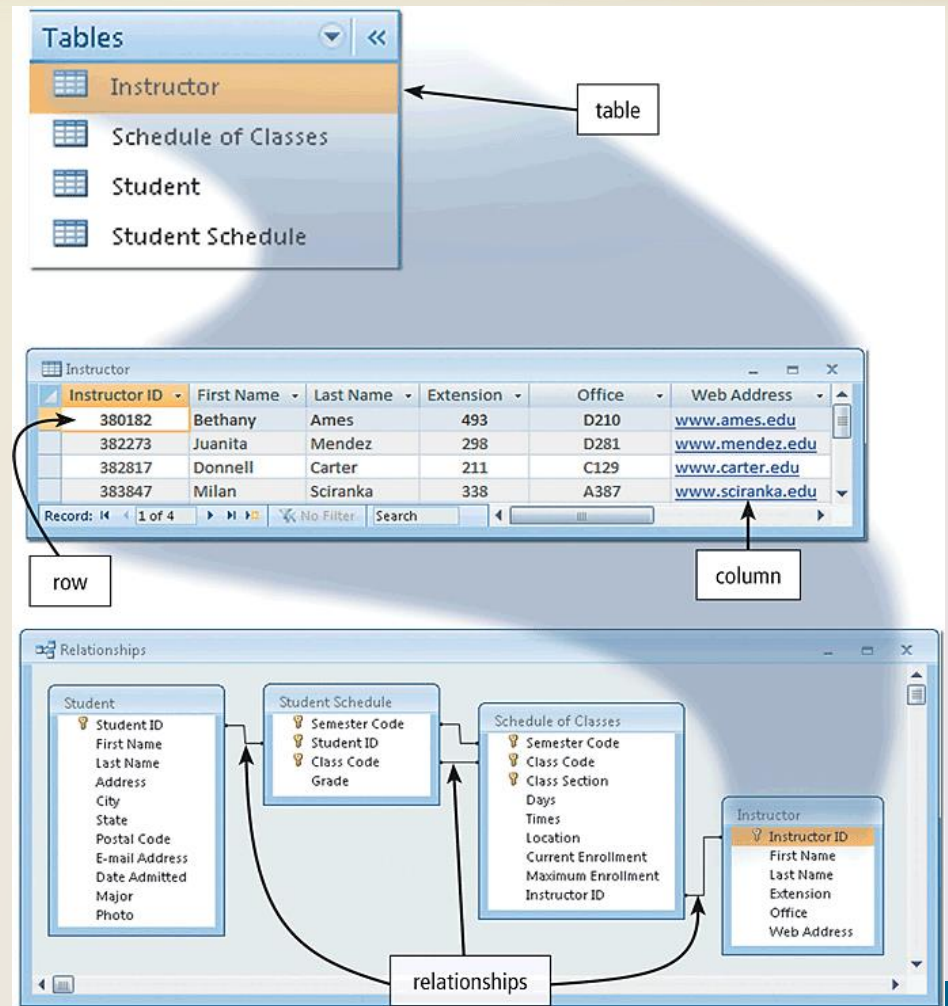
Relational, Object-Oriented, and Multidimensional Databases

- An **object-oriented database** (**OODB**) stores data in **objects**

- Examples of applications appropriate for an object-oriented database include:
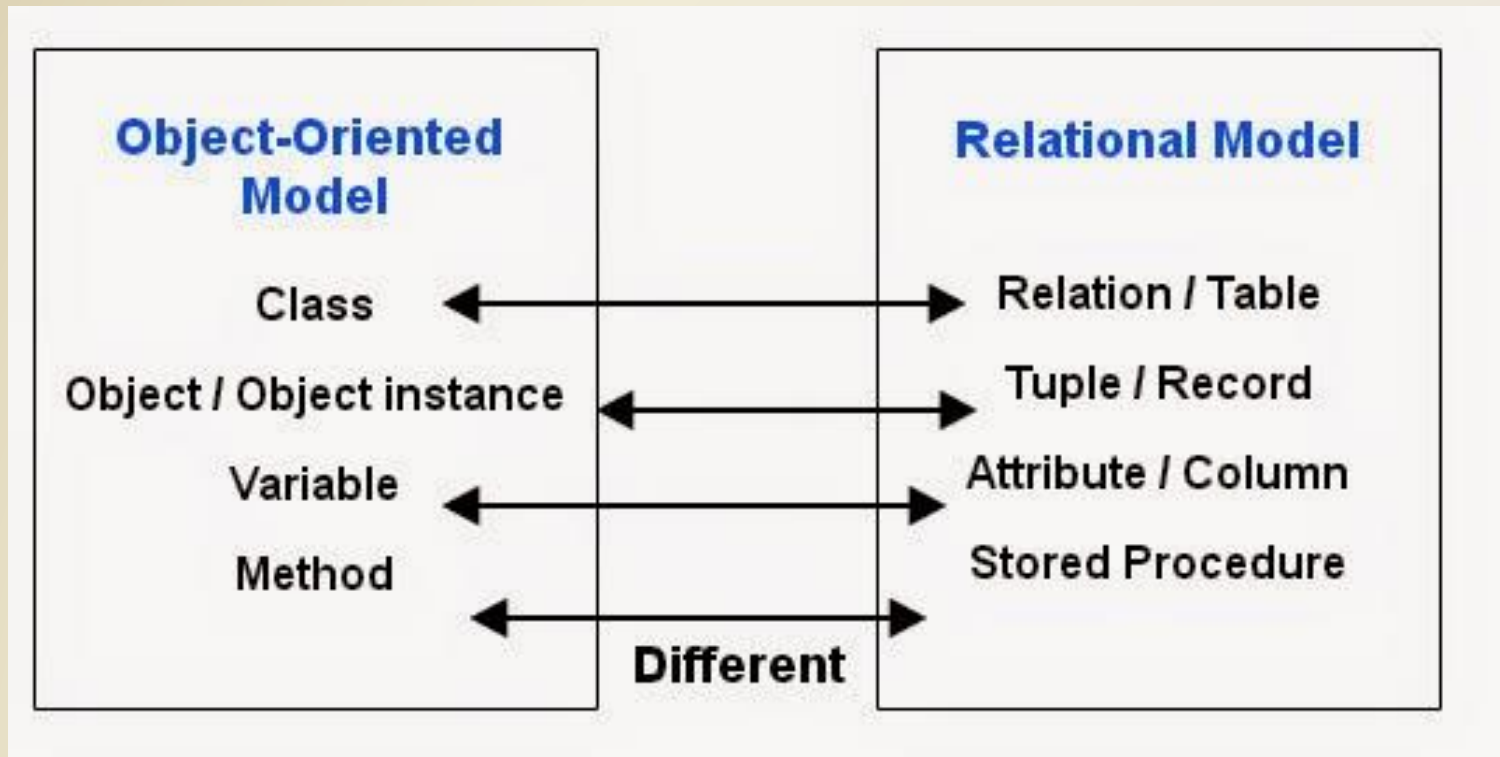
Multimedia database	Groupware database
Computer-aided design database	Hypertext database

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Relational vs. Object-Oriented Databases

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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 *central repository for all or significant parts of the data* that an enterprise's various business systems collect.

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

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 Management

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Chapter 10 Complete