## CS122 Using Relational Databases and SQL
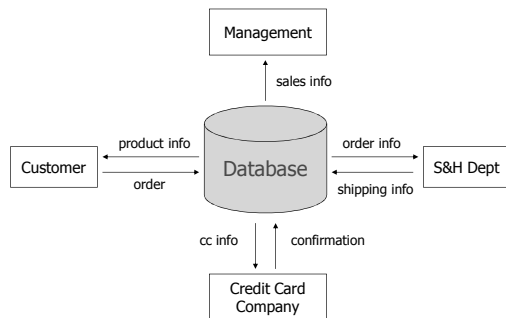Introduction to Relational Databases and SQL


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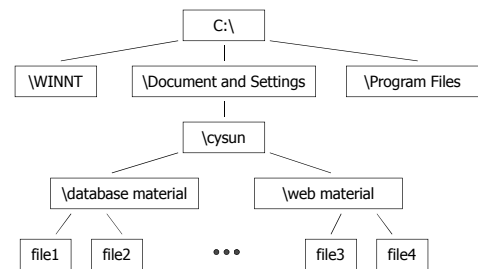---

# Ubiquity of Databases

❖ Anywhere where a large amount of information needs to be managed safely and efficiently
  ▪ Utility companies, grocery stores
  ▪ Schools
  ▪ Doctor's offices, hospitals
  ▪ Government agencies
  ▪ Web sites
  ▪ …
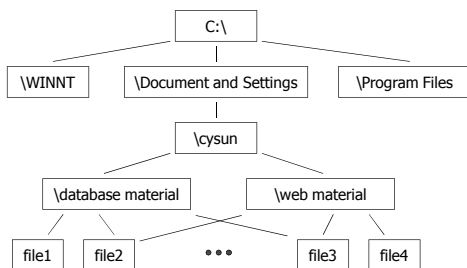
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# An Example of a Database Application

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# Hierarchical Model

*What about material related to both web and database??*

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# Network Model

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# Relational Model
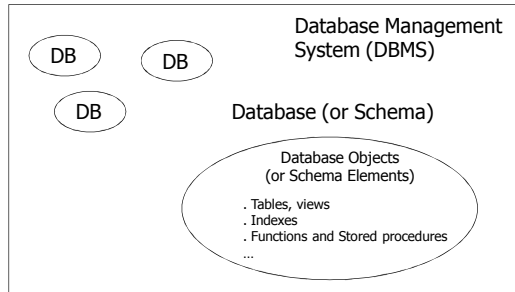
❖ Proposed by Edgar F. Codd in early 1970's
❖ Data is stored in tables
❖ All major database systems these day are relational

| student_id | first_name | last_name | birthday |
|------------|------------|-----------|----------|
| 2000001 | John | Doe | 1970-1-1 |
| 2000002 | Jane | Doe | 1971-1-1 |
| 2000003 | Tom | Smith | 1962-2-2 |

*So how do we store the directory structure in a table??*

## The Big Picture

Database Management System (DBMS)

DB     DB

DB

Database (or Schema)

Database Objects
(or Schema Elements)

. Tables, views
. Indexes
. Functions and Stored procedures
...

## DBMS

◈ Database Management System (DBMS) is a software that manages databases
◈ Common DBMS
  ▪ Commercial – Oracle, IBM DB2, MS SQL Server, Access
  ▪ Open source – MySQL, PostgreSQL

## Database and Schema

◈ A database (a.k.a. schema) is a collection of data managed by a DBMS
◈ A database contains a number of *database objects (a.k.a. schema elements)*, such as tables, indexes, stored procedures, and so on.
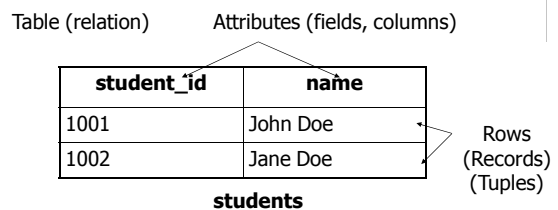
## More Terminology

Table (relation)          Attributes (fields, columns)

| student_id | name |
|------------|----------|
| 1001 | John Doe |
| 1002 | Jane Doe |

**students**

Rows
(Records)
(Tuples)

Table (relation) schema:
    students( student_id, name )

Database schema: database name + table schemas

## Attribute Type

◈ Determines the storage required for a field
◈ Common attribute types
  ▪ String types
  ▪ Numeric types
  ▪ Date and time types
  ▪ Other types

## SQL

◈ Structured Query Language
◈ A standard query language for relational databases
◈ Supported by all major DBMS (with some variations)

## Some SQL Examples

- Create a table
- Populate the table
- Find some information
- Delete the table

## SQL Script

- A text file contains SQL *statements* and *comments*
  - Statements: `select, insert, create` …
  - Comments: lines started with **--**
- Usually uses the .sql suffix
- Run SQL scripts
  - mysql: \. *script.sql* or source *script.sql*
  - MySQL Workbench: *Execute SQL File*
  - phpMyAdmin: copy&paste to the *SQL* tab

## Database Development

| | |
|---|---|
| Design | Given an application scenario, design the database schema. |
| Implementation | Implement the schema in a specific DBMS with constraints, indexes, stored procedures …. |
| Access | Input and retrieve data. |

CS 122