

Computer Fundamental

Lecture 7

By

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Introduction to Database Systems

Course Overview

- Several main topics
 - Database systems
 - Data models
 - Database design
 - SQL
 - Transactions
 - Concurrency
 - Administration

Why Study Databases?

- Databases are useful
 - Many computing applications deal with large amounts of information
 - Database systems give a set of tools for storing, searching and managing this information

What is a Database?

- “A set of information held in a computer”

Oxford English Dictionary

- “One or more large structured sets of persistent data, usually associated with software to update and query the data”

Free On-Line Dictionary of Computing

- “A collection of data arranged for ease and speed of search and retrieval”

Dictionary.com

Databases

- Web indexes
- Library catalogues
- Medical records
- Bank accounts
- Stock control
- Personnel systems
- Product catalogues
- Telephone directories
- Train timetables
- Airline bookings
- Credit card details
- Student records
- Customer histories
- Stock market prices
- Discussion boards
- and so on...

Database Users

- End users
 - Use the database system to achieve some goal
- Application developers
 - Write software to allow end users to interface with the database system
- Database Administrator (DBA)
 - Designs & manages the database system
- Database systems programmer
 - Writes the database software itself

Database Management Systems

- A database is a collection of information
- A database management system (DBMS) is the software that controls that information
- Examples:
 - Oracle
 - DB2 (IBM)
 - MS SQL Server
 - MS Access
 - Ingres
 - PostgreSQL
 - MySQL

What the DBMS does

- Provides users with
 - Data definition language (DDL)
 - Data manipulation language (DML)
 - Data control language (DCL)
- Often these are all the same language
- DBMS provides
 - Persistence
 - Concurrency
 - Integrity
 - Security
 - Data independence
- Data Dictionary
 - Describes the database itself

File Based Systems

- File based systems
 - Data is stored in files
 - Each file has a specific format
 - Programs that use these files depend on knowledge about that format
- Problems:
 - No standards
 - Data duplication
 - Data dependence
 - No way to generate ad hoc queries
 - No provision for security, recovery, concurrency, etc.

Relational Systems

- Information is stored as *tuples* or *records* in *relations* or *tables*
- There is a sound mathematical theory of relations
- Most modern DBMS are based on the relational model
- The relational model covers 3 areas:
 - Data structure
 - Data integrity
 - Data manipulation
- More details in the next lecture...

Table

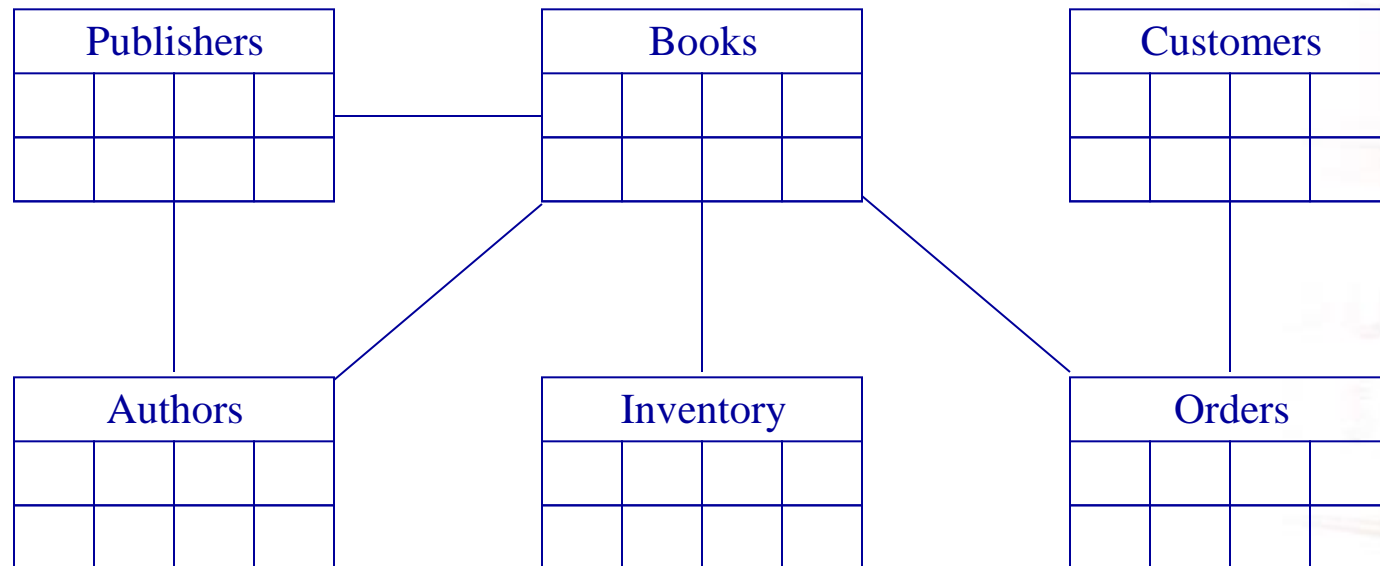
- “A *table* is the primary unit of physical storage for data in a database.”¹
- Usually a database contains more than one table.

Table

Name	Company	Phone Number	E-mail Address
Vedat Diker	CLIS/UMD	(301) 405 9814	vedat@umd.edu
Bugs Bunny	Acme, Inc.	(123) 555 9876	bugs@acme.com
Will E. Coyote	Acme, Inc.	(123) 555 9821	will@acme.com

A Database with Multiple Tables

[1]



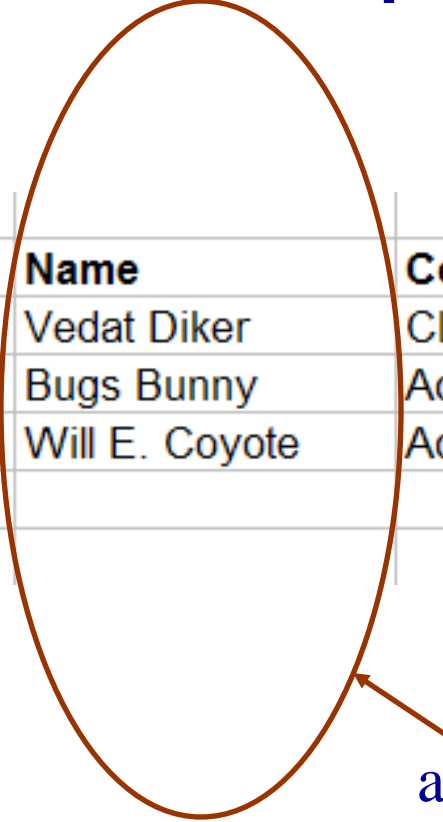
Table

Customers

Name	Company	Phone Number	E-mail Address
Vedat Diker	CLIS/UMD	(301) 405 9814	vedat@umd.edu
Bugs Bunny	Acme, Inc.	(123) 555 9876	bugs@acme.com
Will E. Coyote	Acme, Inc.	(123) 555 9821	will@acme.com

Field (Column)

Customers



Name	Company	Phone Number	E-mail Address
Vedat Diker	CLIS/UMD	(301) 405 9814	vedat@umd.edu
Bugs Bunny	Acme, Inc.	(123) 555 9876	bugs@acme.com
Will E. Coyote	Acme, Inc.	(123) 555 9821	will@acme.com

a field

Record (Row)

Customers

Name	Company	Phone Number	E-mail Address
Vedat Diker	CLIS/UMD	(301) 405 9814	vedat@umd.edu
Bugs Bunny	Acme, Inc.	(123) 555 9876	bugs@acme.com
Will E. Coyote	Acme, Inc.	(123) 555 9821	will@acme.com

a record

Primary Key

Roles (Performances)



Actor/Actress	Movie	Character Name
Keanu Reeves	Matrix	Neo
Laurence Fishburne	Matrix	Morpheus
Carrie-Anne Moss	Matrix	Trinity
Keanu Reeves	Sweet November	Nelson Moss
Charlize Theron	Sweet November	Sara Deever
Charlize Theron	Waking Up in Reno	Candy Kirkendall
Laurence Fishburne	Othello	Othello
Ted Lange	Othello	Othello

primary key fields

A primary key can consist of more than one field.

primary key field

Foreign Key

parent table

Directors

Director ID	Name	Date of Birth	Place of Birth	Biography
785	John Frankenheimer	19-Feb-30	New York, NY	Born in New York and raised in Queens, ...
235	Ridley Scott	30-Nov-37	South Shields, UK	Education: Royal College of Art, London...
976	James Foley	28-Dec-53	Brooklyn, NY	Attended the USC Film School...

relationship

Movies

child table

Movie ID	Title	Director ID	Genre	...
4532	Gladiator	235	Action	
8357	Swwet and Lowdown	497	Comedy	
7465	Confidence	976	Drama	

foreign key field

Relationship Types

- One-to-one
- One-to-many
- Many-to-many

Data Types

- Alphanumeric (Text, Memo)
- Numeric (Number, Currency, etc.)
- Date/Time
- Boolean (Yes/No)

Entity

- “An *entity* is a business object that represents a group, or category of data.”¹
- Do we know a similar concept?

Attribute

- “An *attribute* is a sub-group of information within an entity.”¹
- Do we know a similar concept?

Relationship

- A *relationship* is a link that relates two entities that share one or more attributes.
- Do we know a similar concept?

Database Types

- Flat-file
- Hierarchical
- Network
- **Relational**
- Object-oriented
- Object-relational