Chapter 1

Introduction of Database

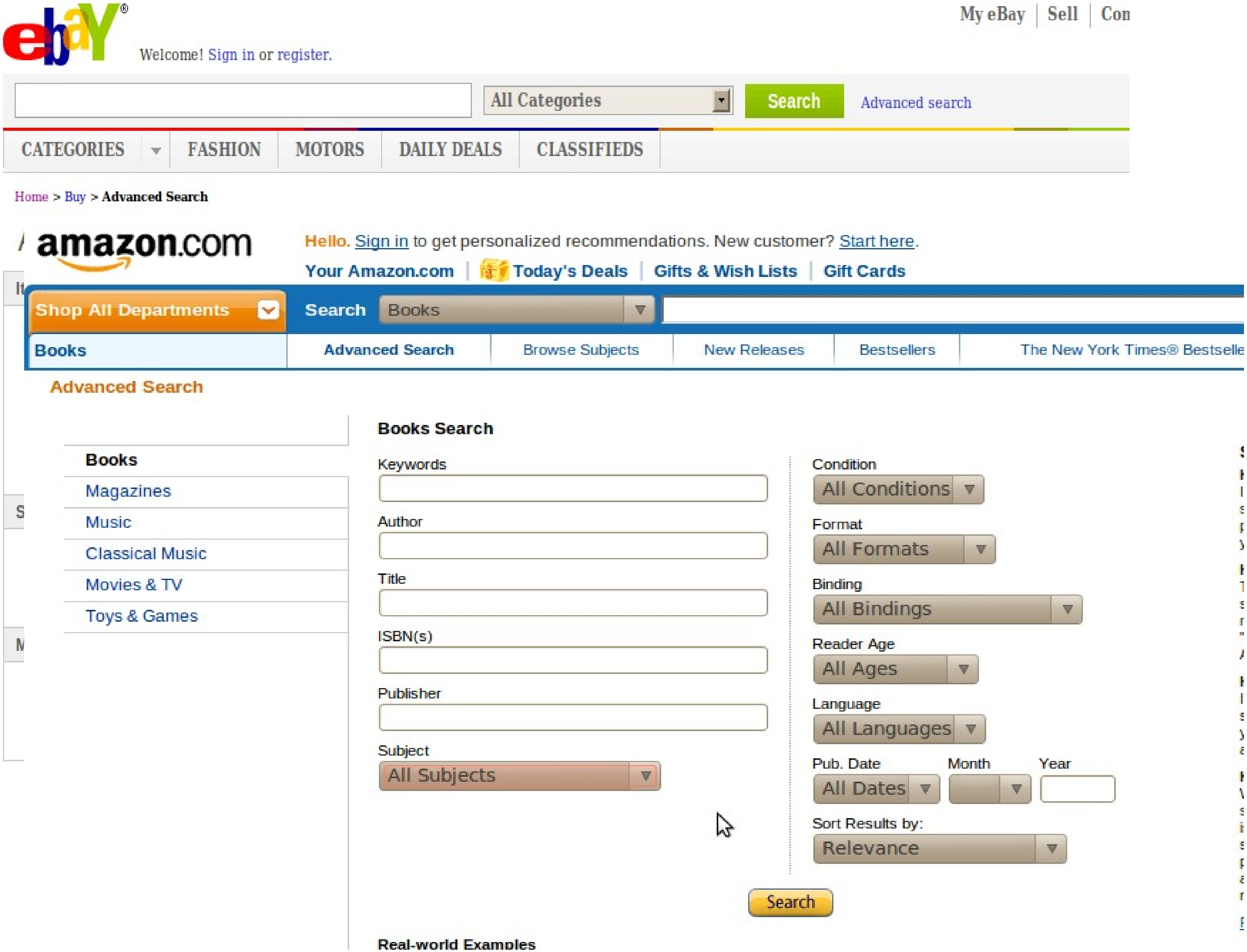
(from ElMasri&Navathe and my editing)

Data

- Structured Data
  - Strict format data like table data
- Semi Structured Data
  - Certain structure but not all have identical structure like share attributes. Format unstructured but content structured or vice versa
- Unstructured Data
  - Limited indication the type of data like documents

Types of Databases and Database Applications

- Numeric and Textual Databases
- Multimedia Databases
- Geographic Information Systems (GIS)
- Data Warehouses
- Real-time and Active Databases
- Mobile Database
- Genome Data Management ..etc



Books Search

Keywords

Author

Title

ISBN(s)

Publisher

Subject: All Subjects

Condition: All Conditions

Format: All Formats

Binding: All Bindings

Reader Age: All Ages

Language: All Languages

Pub. Date: All Dates | Month | Year

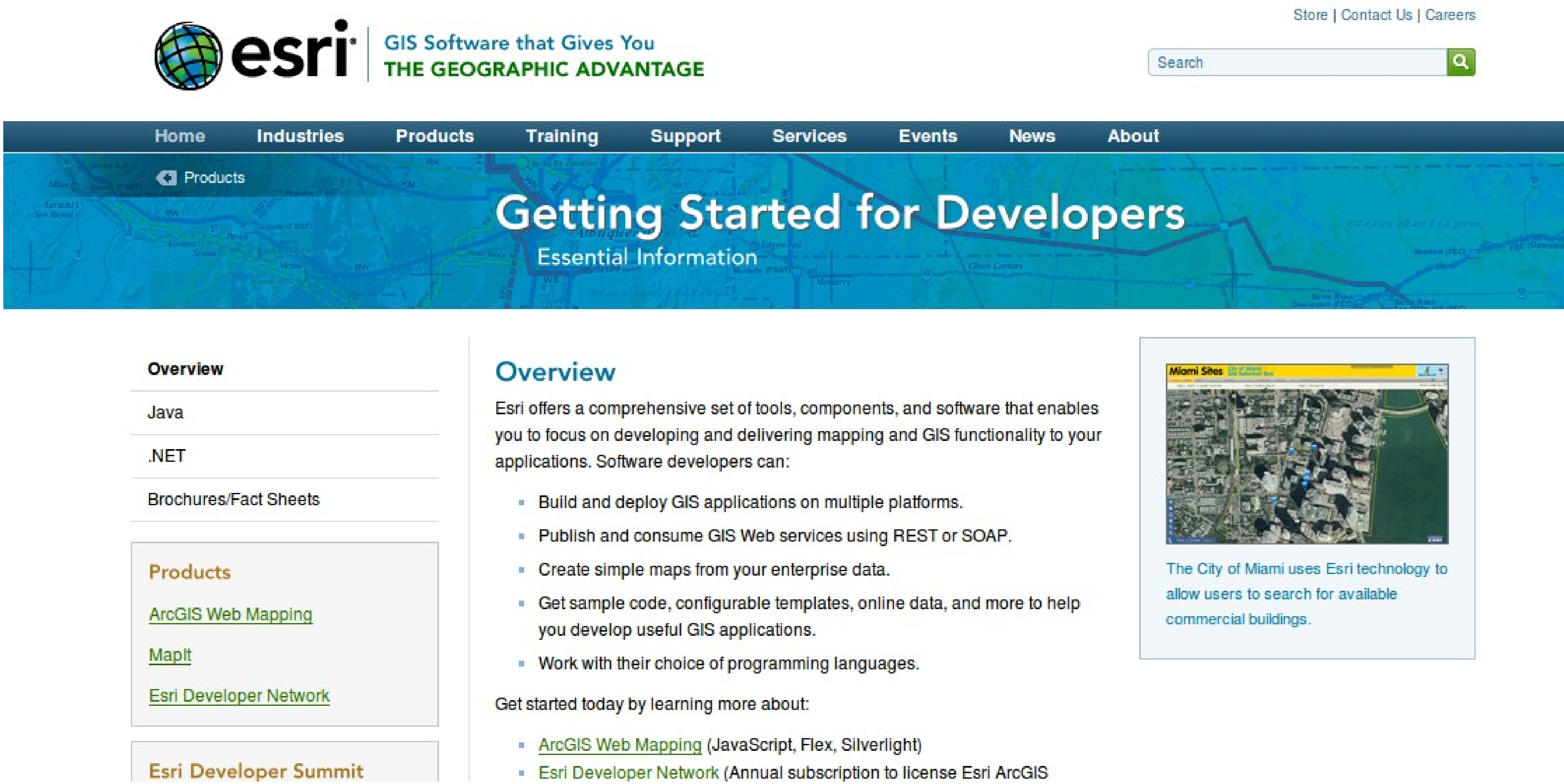
Sort Results by: Relevance

Basic Definitions

- **Data**: Known facts that can be recorded and have an implicit meaning.
- **Database**: A collection of related data.
- Database Management System (DBMS): A software package/ system to facilitate the creation and maintenance of a computerized database.
- Database System: The DBMS software together with the data itself. Sometimes, the applications are also included.
- **Mini-world**: Some part of the real world about which data is stored in a database. For example, student grades and transcripts at a university.

- DBMS tools:
  - MySQL,
  - MSSQL,
  - Oracle,
  - OpenDatabase,
  - MS.Access,
  - PostGreSQL,

  etc



Getting Started for Developers

Essential Information

Overview

Esri offers a comprehensive set of tools, components, and software that enables you to focus on developing and delivering mapping and GIS functionality to your applications. Software developers can:

- Build and deploy GIS applications on multiple platforms.
- Publish and consume GIS Web services using REST or SOAP.
- Create simple maps from your enterprise data.
- Get sample code, configurable templates, online data, and more to help you develop useful GIS applications.
- Work with their choice of programming languages.

Get started today by learning more about:

- ArcGIS Web Mapping (JavaScript, Flex, Silverlight)
- Esri Developer Network (Annual subscription to license Esri ArcGIS

The City of Miami uses Esri technology to allow users to search for available commercial buildings.

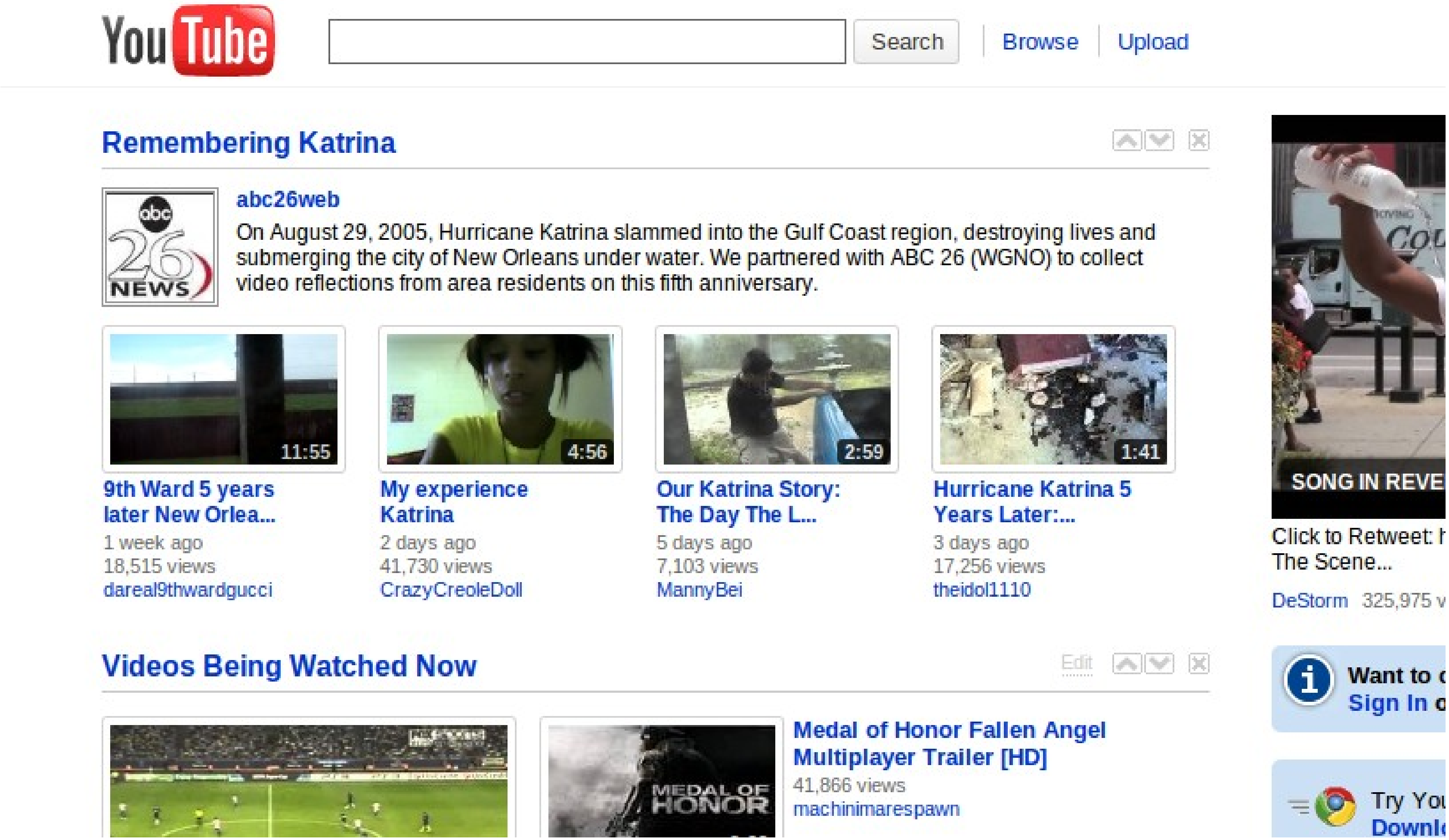
Products

ArcGIS Web Mapping

MapIt

Esri Developer Network

Esri Developer Summit



Remembering Katrina

abc26web

On August 29, 2005, Hurricane Katrina slammed into the Gulf Coast region, destroying lives and submerging the city of New Orleans under water. We partnered with ABC 26 (WGNO) to collect video reflections from area residents on this fifth anniversary.

9th Ward 5 years later New Orlea...	**My experience Katrina**	**Our Katrina Story: The Day The L...**	**Hurricane Katrina 5 Years Later:...**
1 week ago	2 days ago	5 days ago	3 days ago
18,515 views	41,730 views	7,103 views	17,256 views
dareal9thwardgucci	CrazyCreoleDoll	MannyBei	theidol1110

Click to Retweet: I
The Scene...

DeStorm 325,975 v

Videos Being Watched Now

Medal of Honor Fallen Angel Multiplayer Trailer [HD]
41,866 views
machinimarespawn

Want to c
Sign In c

Try You
Downl

Properties in Database

- Represents **some aspects** of the real world, called miniworld or Universe of Discourse
- **Logically coherent** collection of data with some inherent meaning
- Designed, built and populated for **specific purpose**

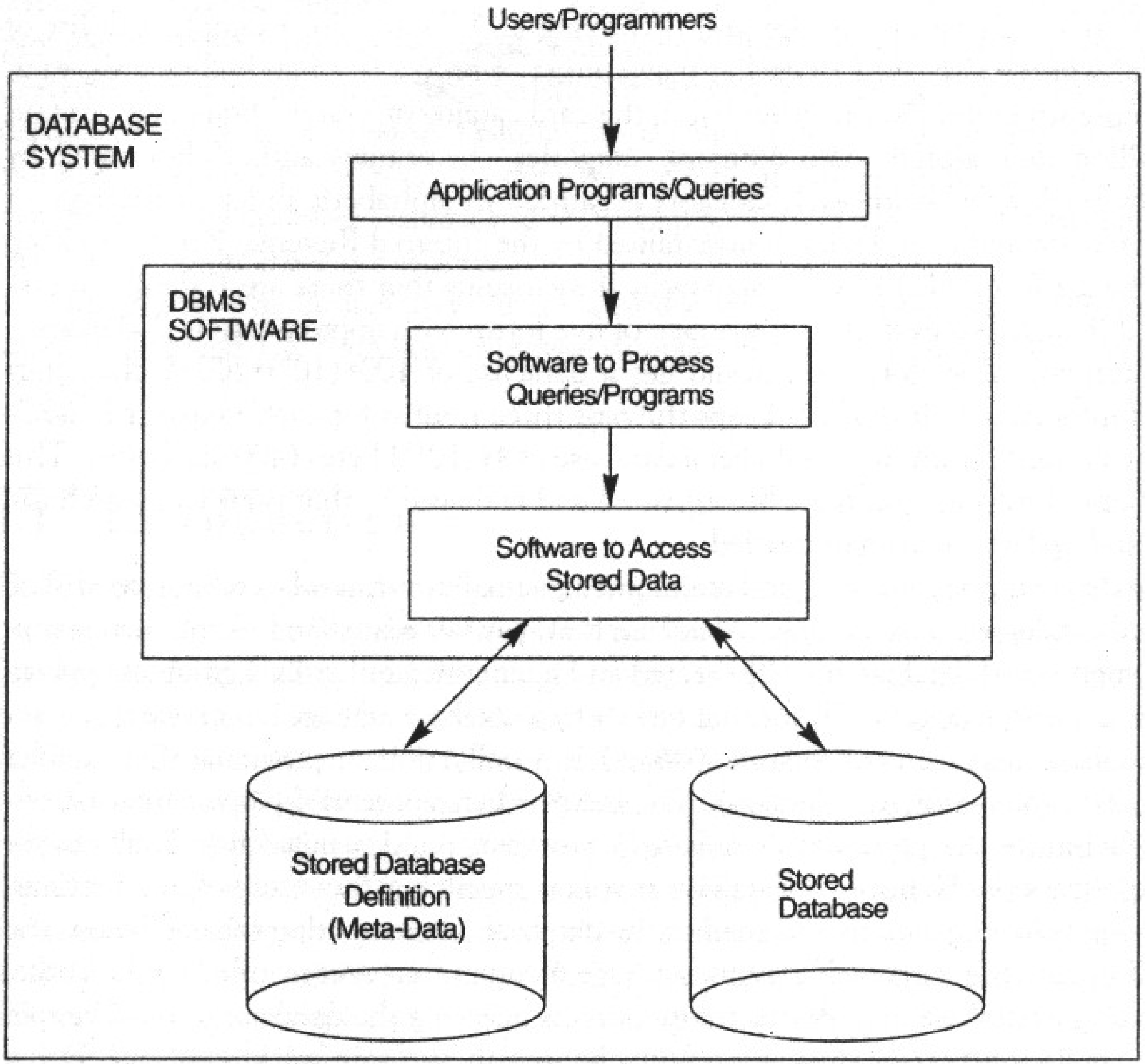
DBMS

- **Database Management System** is a general purpose software system that facilitates the process of
  - defining,
  - constructing
  - manipulating

database for various applications

Main function of DBMS

- **Defining a Database:**
  - Specifying Data Types, Structures, and Constraints
- **Constructing a Database:**
  - the Process of Storing the Data Itself on Some Storage Medium
- **Manipulating a Database:**
  - Function for Querying Specific Data in the Database and Updating the Database


Users/Programmers
DATABASE SYSTEM
Application Programs/Queries
DBMS SOFTWARE
Software to Process Queries/Programs
Software to Access Stored Data
Stored Database Definition (Meta-Data)
Stored Database

Example of a Database (with a Conceptual Data Model)

- **Mini-world for the example**: Part of a UNIVERSITY environment.
- **Some mini-world *entities***:
  - STUDENTs
  - COURSEs
  - SECTIONs (of COURSEs)
  - (academic) DEPARTMENTs
  - INSTRUCTORs

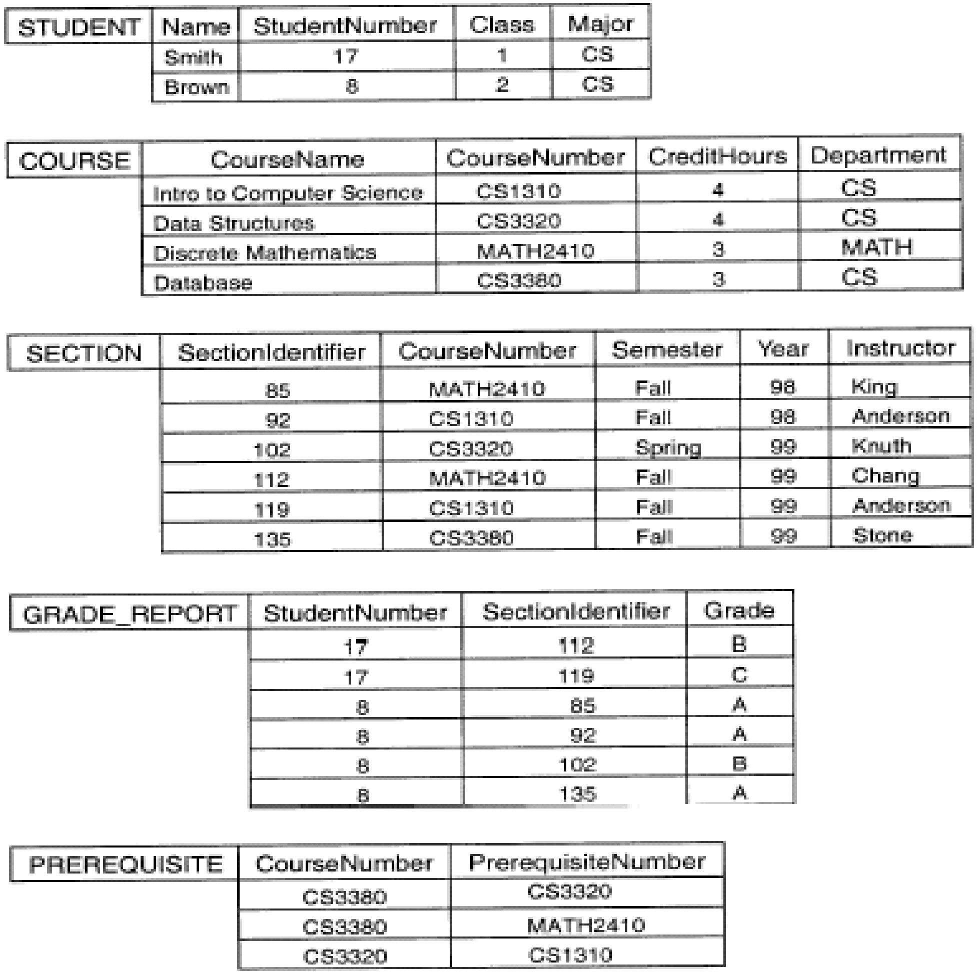
Note: The above could be expressed in the ENTITY-RELATIONSHIP data model.

Example of a Database (with a Conceptual Data Model)

- Some mini-world *relationships*:
  - SECTIONs *are of* specific COURSEs
  - STUDENTs *take* SECTIONs
  - COURSEs *have* prerequisite COURSEs
  - INSTRUCTORs *teach* SECTIONs
  - COURSEs *are offered by* DEPARTMENTs
  - STUDENTs *major in* DEPARTMENTs

Note: The above could be expressed in the *ENTITY-RELATIONSHIP* data model.

Example of a Database System



STUDENT	Name	StudentNumber	Class	Major
	Smith	17	1	CS
	Brown	8	2	CS

COURSE	CourseName	CourseNumber	CreditHours	Department
	Intro to Computer Science	CS1310	4	CS
	Data Structures	CS3320	4	CS
	Discrete Mathematics	MATH2410	3	MATH
	Database	CS3380	3	CS

SECTION	SectionIdentifier	CourseNumber	Semester	Year	Instructor
	85	MATH2410	Fall	98	King
	92	CS1310	Fall	98	Anderson
	102	CS3320	Spring	99	Knuth
	112	MATH2410	Fall	99	Chang
	119	CS1310	Fall	99	Anderson
	135	CS3380	Fall	99	Stone

GRADE_REPORT	StudentNumber	SectionIdentifier	Grade
	17	112	B
	17	119	C
	8	85	A
	8	92	A
	8	102	B
	8	135	A

PREREQUISITE	CourseNumber	PrerequisiteNumber
	CS3380	CS3320
	CS3380	MATH2410
	CS3320	CS1310

The other …

- Miniworld: a part of Library environment
- Entities:
  - Librarians
  - Users
  - Books/Library resources

- Relationships
  - Librarian *serve* User
  - User *borrow/bring back* Book
  - Book *has been borrowed by* User
  - Librarian *manage* Book

- Librarian

  ID, Name, Gender,Phone,Address,Dayhour

- User

  ID,Name,Gender,No.ID,Phone,Address

- Book

  IDCode,Title,Author,Publisher,Year,ISBN

Main Characteristics of the Database Approach

- Self-describing nature of a database system: A DBMS **catalog** stores the *description* of the database. The description is called **meta-data**). This allows the DBMS software to work with different databases.
- Insulation between programs and data: Called **program-data independence**. Allows changing data storage structures and operations without having to change the DBMS access programs.

Main Characteristics of the Database Approach

- Data Abstraction: A **data model** is used to hide storage details and present the users with a *conceptual view* of the database.
- Support of multiple views of the data: Each user may see a different view of the database, which describes *only* the data of interest to that user.

Main Characteristics of the Database Approach

- Sharing of data and multiuser transaction processing : allowing a set of concurrent users to retrieve and to update the database. Concurrency control within the DBMS guarantees that each **transaction** is correctly executed or completely aborted. OLTP (Online Transaction Processing) is a major part of database applications.

Database Users

Users may be divided into those who actually use and control the content (called “Actors on the Scene”) and those who enable the database to be developed and the DBMS software to be designed and implemented (called “Workers Behind the Scene”).

Database Users

Actors on the scene

- **Database administrators:** responsible for authorizing access to the database, for co-ordinating and monitoring its use, acquiring software, and hardware resources, controlling its use and monitoring efficiency of operations.
- **Database Designers:** responsible to define the content, the structure, the constraints, and functions or transactions against the database. They must communicate with the end-users and understand their needs.
- **End-users:** they use the data for queries, reports and some of them actually update the database content.

Categories of End-users

- **Casual** : access database occasionally when needed
- **Naïve or Parametric** : they make up a large section of the end-user population. They use previously well-defined functions in the form of "canned transactions" against the database. Examples are bank-tellers or reservation clerks who do this activity for an entire shift of operations.

Categories of End-users

- **Sophisticated** : these include business analysts, scientists, engineers, others thoroughly familiar with the system capabilities. Many use tools in the form of software packages that work closely with the stored database.
- **Stand-alone** : mostly maintain personal databases using ready-to-use packaged applications. An example is a tax program user that creates his or her own internal database.

Advantages of Using the Database Approach

- Controlling redundancy in data storage and in development and maintenence efforts.
- Sharing of data among multiple users.
- Restricting unauthorized access to data.
- Providing persistent storage for program Objects
- Providing Storage Structures for efficient Query Processing

Advantages of Using the Database Approach

- Providing backup and recovery services.
- Providing multiple interfaces to different classes of users.
- Representing complex relationships among data.
- Enforcing integrity constraints on the database.
- Drawing Inferences and Actions using rules

Additional Implications of Using the Database Approach

- Potential for enforcing standards: this is very crucial for the success of database applications in large organizations Standards refer to data item names, display formats, screens, report structures, meta-data (description of data) etc.
- Reduced application development time: incremental time to add each new application is reduced.

Additional Implications of Using the Database Approach

- Flexibility to change data structures: database structure may evolve as new requirements are defined.
- Availability of up-to-date information – very important for on-line transaction systems such as airline, hotel, car reservations.
- Economies of scale: by consolidating data and applications across departments wasteful overlap of resources and personnel can be avoided.

Historical Development of Database Technology

- **Early Database Applications:** The Hierarchical and Network Models were introduced in mid 1960’s and dominated during the seventies. A bulk of the worldwide database processing still occurs using these models.
- **Relational Model based Systems:** The model that was originally introduced in 1970 was heavily researched and experimented with in IBM and the universities. Relational DBMS Products emerged in the 1980’s.

Historical Development of Database Technology

- **Object-oriented applications:** OODBMSs were introduced in late 1980's and early 1990's to cater to the need of complex data processing in CAD and other applications. Their use has not taken off much.
- **Data on the Web and E-commerce Applications:** Web contains data in HTML (Hypertext markup language) with links among pages. This has given rise to a new set of applications and E-commerce is using new standards like XML (eXtended Markup Language).

Extending Database Capabilities

- New functionality is being added to DBMSs in the following areas:
  - Scientific Applications
  - Image Storage and Management
  - Audio and Video data management
  - Data Mining
  - Spatial data management
  - Time Series and Historical Data Management

The above gives rise to new research and development in incorporating new data types, complex data structures, new operations and storage and indexing schemes in database systems.

When not to use a DBMS

- Main inhibitors (costs) of using a DBMS:
  - High initial investment and possible need for additional hardware.
  - Overhead for providing generality, security, concurrency control, recovery, and integrity functions.
- When a DBMS may be unnecessary:
  - If the database and applications are simple, well defined, and not expected to change.
  - If there are stringent real-time requirements that may not be met because of DBMS overhead.
  - If access to data by multiple users is not required.

When not to use a DBMS

- When no DBMS may suffice:
  - If the database system is not able to handle the complexity of data because of modeling limitations
  - If the database users need special operations not supported by the DBMS.

Homefun

- For next class
- Reading Chapter 2
- Exercise 1.3, 1.4,1.5, 1.7