Introduction to Database Systems

Why Study Databases??
- Shift from computation to information
  - at the “low end”: scramble to webspace (a mess!)
  - at the “high end”: scientific applications
- Datasets increasing in diversity and volume.
  - Digital libraries, interactive video, Human Genome project, EOS project
  - ... need for DBMS exploding
- DBMS encompasses most of CS
  - OS, languages, theory, “A”I, multimedia, logic

What Is a DBMS?
- A very large, integrated collection of data
- Models real-world enterprise
  - Entities (e.g., students, courses)
  - Relationships (e.g., Madonna is taking CS432)
- A Database Management System (DBMS) is a software package designed to store and manage databases

Why Use a DBMS?
- Reduced application development time (Queries)
- Data independence and efficient access
- Concurrent access
- Crash recovery
- Uniform data administration

Data Models
- A data model is a collection of concepts for describing data.
- A schema is a description of a particular collection of data, using the a given data model.
- The relational model of data is the most widely used model today.
  - Main concept: relation, basically a table with rows and columns.
  - Every relation has a schema, which describes the columns, or fields.
**Data Independence**

- Applications insulated from how data is structured and stored.
- **Physical data independence**: Protection from changes in physical structure of data.
- **Logical data independence**: Protection from changes in logical structure of data.

*One of the most important benefits of using a DBMS!*

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**Concurrency Control**

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**Recovery**

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**Structure of a DBMS**

- A typical DBMS has a layered architecture.
- The figure does not show the concurrency control and recovery components.
- This is one of several possible architectures; each system has its own variations.

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**Summary**

- DBMS used to maintain, query large datasets.
  - Benefits include quick application development, data independence, concurrency control, recovery
- A DBMS typically has a layered architecture.
- DBMS R&D is one of the broadest, most exciting areas in CS.
- DBAs hold responsible jobs and are well-paid!