

Databases and Database Management System

Goals

- comprehensive introduction to
 - the design of databases
 - database transaction processing
 - the use of database management systems for applications

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Topics

- the entity-relationship (E/R) and relational data models
- approaches to database design
- abstract query languages (relational algebra)
- SQL
- issues in database design and use (views, integrity constraints, triggers, transactions, and security)
- physical data organization
- query processing and optimization
- transaction processing
- advanced topics (data warehouses, data mining, temporal databases, and XML) *[time permit]*

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Book

1. Textbook: Databases and Transaction Processing – An Application-Oriented Approach by Lewis, Bernstein, and Kifer (Addison Wesley)
2. Additional reading:
 1. A first course in Database Systems by *Ullman & Widom*
 2. Database systems the complete book by *Garcia-Molina, Ullman, & Widom*

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Organizational issues

- Class web site:
<http://www.cs.nmsu.edu/~tson/classes/fall03-482>
- 5 weeks: First mid-term (September 18)
- 11 weeks: Second mid-term (October 28)
- December 8: Final
- Office hours: 4-5 pm Tues & Thus. I will need to go home right after the class on Tues, please do not try to ask questions after Tue's class
- Use of emails: questions, notifications
- Homework submission – web based

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Questions

- What is a database?
- What is its use?
- What is required?
- How does it work?

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Example – Credit Card Use

- Sweep the card
- Wait for a few seconds
- Get approval
- Take the good
- End of month: sending the payment or in debt

Parties involved:

- Self
- Salesperson

People involved:

- Self
- Sales company
- Credit card company

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Transactions

- Buyer gets the good
- Seller gets the money
- The money route: buyer → credit card company → seller
- The credit card company
 - has the information of the buyer (credit card holder) and the seller,
 - bills the buyer, and
 - pays the seller

The company has a database of customers

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What is a Database?

- American Heritage Dictionary: a *collection of data* organized for *easy* and *speed* of search and retrieval

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What is a Database?

- Related to data, perhaps lot of them
 - same characteristics
 - over long period of time (months, years, ...)
- Pertinent to people who use the data
- Might or might not be of interest to other

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Definition and Properties

- **Definition:** A database is a collection of data central to some enterprise that is managed by a Database Management System (**DBMS**)
- **Properties:**
 - Essential to operation of enterprise (contains the only record of enterprise activity)
 - Valuable to the enterprise (Historical data can guide enterprise strategy, might be of interest to other enterprises)
 - Reflection of the state of the enterprise (database is persistent)

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DBMS

- Specialized software manages databases
 - create new databases
 - modify existing databases (update data, create reports for different purposes)
- Supports
 - high-level access language (e.g. SQL)
 - application describes database accesses using that language.

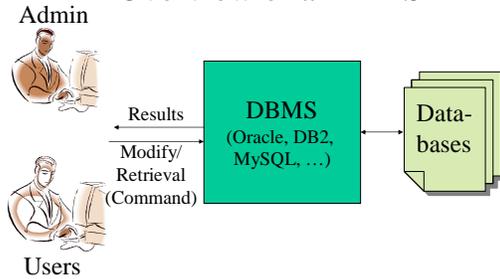
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DBMS

- Provides users with
 - Persistent storage: like file system but much more flexible
 - Programming interface: accessing and modifying data through a query language
 - Transaction management: concurrent access to data

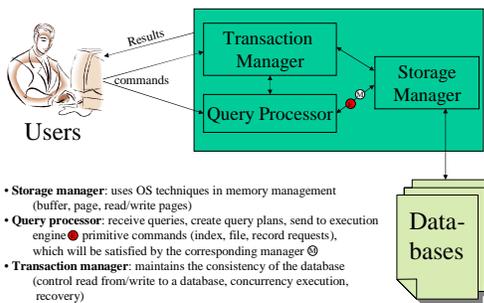
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Overview of a DBMS



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Overview of a DBMS (Cont.)



- **Storage manager:** uses OS techniques in memory management (buffer, page, read/write pages)
- **Query processor:** receive queries, create query plans, send to execution engine ● primitive commands (index, file, record requests), which will be satisfied by the corresponding manager ☉
- **Transaction manager:** maintains the consistency of the database (control read from/write to a database, concurrency execution, recovery)

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Overview of a DBMS (Cont.)

- Database administrator:
 - set-up databases
 - creates new schema
 - modifies existing schema
 - manages users (authorization, permission, etc.)
 - uses Data Definition Language – a specialized language for creating and defining database schema

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