Databases and Database Management System

Goals

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

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]

Book

2. Additional reading:
   1. A first course in Database Systems by Ullman & Widom
   2. Database systems the complete book by Garcia-Molina, Ullman, & Widom

Organizational issues

- Class web site: http://www.cs.unmsu.edu/~tsom/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

Questions

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

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.

Parties involved:
- Self
- Salesperson

People involved:
- Self
- Sales company
- Credit card company

What is a Database?

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

What is a Database?

- Related to data, perhaps lots 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

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)

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.
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

Overview of a DBMS

DBMS (Oracle, DB2, MySQL, …)

Admin

Results

Modify/
Retrieval
(Command)

Users

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)

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