Why Use A Database?

- The purpose of a database is to help people and organizations keep track of things
- Problems of using list to store data
  - Data inconsistencies
  - Data privacy: The departments want to share some, but not all, of their data
- Databases store data in single-theme tables
- Tables are related through primary and foreign keys

Components of A Database System

- Functions:
  - Create and process forms
  - Create and transmit queries
  - Create and process reports
  - Execute application logic
  - Control application

DBMS

- DBMS: Database Management System
- Functions:
  - Create database, tables, and supporting structures
  - Read and update database data
  - Maintain database structures
  - Enforce rules
  - Control concurrency
  - Provide security
  - Perform backup and recovery
- Example: Oracle, DB2, Microsoft Access, SQL Server

Database

- Database is a self-describing collection of related records or tables
- Components:
  - User Data
  - Metadata: data about the structure of a database
  - Indexes and related structures
  - Stored procedures: program modules stored within the database
  - Triggers: a procedure that is executed when a particular data activity occurs
  - Application metadata: data describing application elements such as forms and reports
Types of Database

- **Personal database**
  - 1 user; < 10 MB
- **Workgroup database**
  - < 25 users; < 100 MB
- **Organizational database**
  - Hundreds to thousands users
  - > 1 Trillion bytes, possibly several databases

Building a Database System

- **3 Phases**
  - **Requirements phase**: a data model is developed
    - Data model is a logical representation of the database structure
  - **Design phase**: the data model is transformed into tables and relationships
  - **Implementation phase**:
    - Tables, relationships, and constraints are created
    - Stored procedures and triggers are written
    - The database is filled and systems are tested
  - Database and its applications will be modified (through these same three phases) to meet new requirements

Application Development

- Application development proceeds in parallel with database development

Example: Organizational Database

Example: Data Model

Example: History of Database Processing
Early Database Models

- Before mid-1960s, only sequential file processing using magnetic tape was possible
- In mid-1960s, disk storage enabled hierarchical and network database
  - IBM’s DL/I (Data Language One)
  - CODASYL’s DBTG (Data Base Task Group) model → the basis of current DBMSs

The Relational Model

- E.F. Codd introduced the relational model in 1970
- DB2 from IBM is the first DBMS product based on the relational model
- Other DBMS based on the relational model were developed in the late 1980s
- Today, DB2, Oracle, and SQL Server are the most prominent commercial DBMS products based on the relational model

Personal Computer DBMS

- The advent of microcomputer increases popularity of personal databases
- Graphical User Interface (GUI) make it easy to use
  - Examples of early DBMS products: dBase, R:base, and Paradox

Object Oriented DBMS (OODBMS)

- Object-oriented programming started in the mid-1980s
- Goal of OODBMS is to store object-oriented programming objects in a database without having to transform them into relational format
- Object-relational DBMS products, such as Oracle 8i and 9i, allow both relational and object views of data on the same database
- Currently, OODBMS have not been a commercial success due to high cost of relational to object-oriented transformation

Recent History

- Success story of the Microsoft Access
  - Microsoft Office suite and Windows integration
  - Easy-to-use and powerful personal DBMS
- Internet database
- XML and database integration