Introduction

- **Definition**: A computerized record keeping system
- A user would want to be able to do (at least):
  - Adding a new empty table (or file for the time being)
  - Inserting new data
  - Retrieving data
  - Updating data
  - Deleting data
  - Removing tables
## An Example of a Relation (a table)

<table>
<thead>
<tr>
<th>BIN#</th>
<th>WINE</th>
<th>PRODUCER</th>
<th>YEAR</th>
<th>BOTTLES</th>
<th>READY</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Chardonnay</td>
<td>Buena Vista</td>
<td>1997</td>
<td>1</td>
<td>1999</td>
</tr>
<tr>
<td>3</td>
<td>Chardonnay</td>
<td>Geyeser Peak</td>
<td>1997</td>
<td>5</td>
<td>1999</td>
</tr>
<tr>
<td>6</td>
<td>Chardonnay</td>
<td>Simi</td>
<td>1996</td>
<td>4</td>
<td>1998</td>
</tr>
<tr>
<td>12</td>
<td>Joh Riesling</td>
<td>Jekel</td>
<td>1998</td>
<td>1</td>
<td>1999</td>
</tr>
<tr>
<td>21</td>
<td>Fume Blanc</td>
<td>Ch St. Jean</td>
<td>1997</td>
<td>4</td>
<td>1999</td>
</tr>
<tr>
<td>22</td>
<td>Fume Blanc</td>
<td>Robt Mondavi</td>
<td>1996</td>
<td>2</td>
<td>1998</td>
</tr>
<tr>
<td>30</td>
<td>Gewurztraminer</td>
<td>Ch St. Jean</td>
<td>1998</td>
<td>3</td>
<td>1998</td>
</tr>
<tr>
<td>43</td>
<td>Cab Sauvignon</td>
<td>Windsor</td>
<td>1991</td>
<td>12</td>
<td>2000</td>
</tr>
<tr>
<td>45</td>
<td>Cab Sauvignon</td>
<td>Geyeser Peak</td>
<td>1994</td>
<td>12</td>
<td>2002</td>
</tr>
<tr>
<td>48</td>
<td>Cab Sauvignon</td>
<td>Robt Mondavi</td>
<td>1993</td>
<td>12</td>
<td>2004</td>
</tr>
<tr>
<td>50</td>
<td>Pinot Noir</td>
<td>Gary Farrell</td>
<td>1996</td>
<td>3</td>
<td>1999</td>
</tr>
<tr>
<td>51</td>
<td>Pinot Noir</td>
<td>Fetzer</td>
<td>1993</td>
<td>3</td>
<td>2000</td>
</tr>
<tr>
<td>52</td>
<td>Pinot Noir</td>
<td>Dehlinger</td>
<td>1996</td>
<td>2</td>
<td>1998</td>
</tr>
<tr>
<td>58</td>
<td>Merlot</td>
<td>Clos du Bois</td>
<td>1994</td>
<td>9</td>
<td>2000</td>
</tr>
<tr>
<td>64</td>
<td>Zinfandel</td>
<td>Cline</td>
<td>1994</td>
<td>9</td>
<td>2003</td>
</tr>
<tr>
<td>72</td>
<td>Zinfandel</td>
<td>Rafanelli</td>
<td>1995</td>
<td>2</td>
<td>2003</td>
</tr>
</tbody>
</table>
SELECT BIN#, WINE, PRODUCER
FROM CELLAR
WHERE READY = 2000;

<table>
<thead>
<tr>
<th>BIN#</th>
<th>WINE</th>
<th>PRODUCER</th>
</tr>
</thead>
<tbody>
<tr>
<td>43</td>
<td>Cab Sauvignon</td>
<td>Windsor</td>
</tr>
<tr>
<td>51</td>
<td>Pinot Noir</td>
<td>Fetzer</td>
</tr>
<tr>
<td>58</td>
<td>Merlot</td>
<td>Clos du Bois</td>
</tr>
</tbody>
</table>

INSERT INTO
CELLAR (BIN#, WINE, PRODUCER, YEAR, BOTTLES, READY)
VALUES (53, 'Pinot Noir', 'Saintsbury', 1997, 6, 2001);

UPDATE CELLAR SET BOTTLES = 4
WHERE BIN# = 3;

DELETE FROM CELLAR WHERE BIN# = 2;
What Is a Database System?

- A computerized system whose overall purpose is to maintain information and to make it available on demand
- Four components: Data, Hardware, Software, and Users
Database Systems (continued)

- **Data**
  - Integrated
    - A unification of several distinct files or tables
  - Shared
    - Individual data shared among different users

- **Hardware**
  - Secondary storage
  - Hardware processors

- **Software**
  - A layer between physical database itself and users
  - a. k. a. Database Management Systems (DBMS)
  - Support user operations
Users

- Application programmers
  - Writing database application programs
- End users
  - Interact with database systems from online applications or terminals
- Database Administrator (DBA)
- See more later
- Computer Programs
  - Computer programs directly talking to database systems
What Is a Database?

- Some data is “persistent”, other data is “transient”
  
  **Persistent Data:** Its lifetime typically exceeds that of application program execution. Persistent from the moment it is created until the moment it is explicitly destroyed.

  Examples:
  - Product Data
  - Account Data
  - Student Data

- Second definition: A database is a collection of **persistent data** that is used by the application systems of some given enterprises
  
  - Bank
  - University
  - Government
Entities and Relationships (E/R)

- **Entities**
  - Any distinguishable objects that is deemed to be of interest

- **Relationships**
  - An association among entities, a special kind of entity.

![E/R Diagram](image)
Why Databases?

- Many obvious advantages
  - Speedy
  - Compact: no need for huge paper files
  - Searchable
  - Current: available on demand at any time

- Also some less obvious advantages
  - Central control of data
  - Redundancy reduced
  - Inconsistencies can be avoided
  - Transaction: (is a logical unit of work, atomicity)
  - Data sharing
  - Standards
  - Integrity: Accuracy or correctness
Relational Systems & Other Database Systems

- A relational database is
  - Data is perceived by the user as tables
  - Operations on data generate answers in the form of new tables

- Why call “Relational”?

- Types of pre-relational database models
  - Hierarchical databases
  - Networks databases and more ...

- Types of post-relational database models
  - Object-relational databases, Object-oriented databases
  - Deductive databases
  - Extendable databases, and more ...
Modern Commercial Databases

- Oracle (Oracle)
- SQL Server (Microsoft)
- MySQL
- DB2 (IBM)
- SAP Sybase ASE
- Informix (IBM)
- Amazon SimpleDB
- PostgreSQL
- NoSQL Systems (differ from relational DB)