CS275 – Intro to Databases

Intro to MySQL & ER Modeling
Chap. 2.1 – 2.3

DBMS Architecture

• Levels of Abstraction

External Schema 1  External Schema 2

    Conceptual Schema
        
    Physical Schema

DBMS Architecture

Web Forms  App Front Ends  SQL Interface

    SQL Commands
        
    DBMS
        
    Database/Physical
MySQL Example/Demo

- Create database
- Switch to database
- Create tables based on logical schema:
  Students(sid: string, name: string, login: string, age: integer, gpa: real)
  Faculty(fid: string, fname: string, sal: real)
  Courses(cid: string, cname: string, credits: integer)
  Enrolled(sid: string, cid: string, grade: string)
  Teaches(fid: string, cid: string)

- Command line vs. Workbench

Database Design

- What is database design?
- What is involved in the process?
- What is ER modeling?
- How do we do ER modeling effectively?

What Is Database Design?

- User Requirements
- Database Design
- Databases/Functionality
What Is Involved?
1. Requirement analysis
2. Conceptual database design
3. Logical database design
4. Schema refinement
5. Physical database design
6. Application and security design

Requirement Analysis
• Need to decide
  – What data is to be stored
  – What applications will make use of the data
  – What operations are most needed
• An informal process

Conceptual Database Design
• Use information from requirement analysis
• Develop high-level description of the data
  – ER modeling
Logical Database Design

• Pick a DBMS (Oracle, MySQL, etc)
• Convert the conceptual database design into a database schema

Schema Refinement

• Identify potential problems and fix them
  – What if we want to add a department 6 with an employee?
  – What if we want to rename department 5?

Physical Database Design

• Performance is the key here
  – Fast retrieval and update
  – May require building indexes and clustering tables
Application and Security Design

- Goes beyond just data
  - Software design and development cycle
  - UML can help
  - Design user roles and relationship to data

Database Design

1. Requirement analysis
2. Conceptual database design
3. Logical database design
4. Schema refinement
5. Physical database design
6. Application and security design
7. Back to any previous step!

ER Modeling

- Entities
- Relationships

- ER = Entity-Relationship
Entities

- Entity
- Entity sets
- Attributes
- Domains

<table>
<thead>
<tr>
<th>ID</th>
<th>Name</th>
<th>Size</th>
<th>Entity Set</th>
<th>Address</th>
<th>Number</th>
<th>Check</th>
<th>Domain</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Name 1</td>
<td>1234</td>
<td>Entity Set 1</td>
<td>Address 1</td>
<td>Number 1</td>
<td>Check 1</td>
<td>Domain 1</td>
</tr>
<tr>
<td>2</td>
<td>Name 2</td>
<td>5678</td>
<td>Entity Set 2</td>
<td>Address 2</td>
<td>Number 2</td>
<td>Check 2</td>
<td>Domain 2</td>
</tr>
</tbody>
</table>

Entities

- Entity
- Entity sets
- Attributes
- Domains

<table>
<thead>
<tr>
<th>ID</th>
<th>Name</th>
<th>Size</th>
<th>Entity Set</th>
<th>Address</th>
<th>Number</th>
<th>Check</th>
<th>Domain</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Name 1</td>
<td>1234</td>
<td>Entity Set 1</td>
<td>Address 1</td>
<td>Number 1</td>
<td>Check 1</td>
<td>Domain 1</td>
</tr>
<tr>
<td>2</td>
<td>Name 2</td>
<td>5678</td>
<td>Entity Set 2</td>
<td>Address 2</td>
<td>Number 2</td>
<td>Check 2</td>
<td>Domain 2</td>
</tr>
</tbody>
</table>

Entities

- Entity
- Entity sets
- Attributes
- Domains

<table>
<thead>
<tr>
<th>ID</th>
<th>Name</th>
<th>Size</th>
<th>Entity Set</th>
<th>Address</th>
<th>Number</th>
<th>Check</th>
<th>Domain</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Name 1</td>
<td>1234</td>
<td>Entity Set 1</td>
<td>Address 1</td>
<td>Number 1</td>
<td>Check 1</td>
<td>Domain 1</td>
</tr>
<tr>
<td>2</td>
<td>Name 2</td>
<td>5678</td>
<td>Entity Set 2</td>
<td>Address 2</td>
<td>Number 2</td>
<td>Check 2</td>
<td>Domain 2</td>
</tr>
</tbody>
</table>

Entities

- Entity
- Entity sets
- Attributes
- Domains

<table>
<thead>
<tr>
<th>ID</th>
<th>Name</th>
<th>Size</th>
<th>Entity Set</th>
<th>Address</th>
<th>Number</th>
<th>Check</th>
<th>Domain</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Name 1</td>
<td>1234</td>
<td>Entity Set 1</td>
<td>Address 1</td>
<td>Number 1</td>
<td>Check 1</td>
<td>Domain 1</td>
</tr>
<tr>
<td>2</td>
<td>Name 2</td>
<td>5678</td>
<td>Entity Set 2</td>
<td>Address 2</td>
<td>Number 2</td>
<td>Check 2</td>
<td>Domain 2</td>
</tr>
</tbody>
</table>

Entities

- Entity
- Entity sets
- Attributes
- Domains

<table>
<thead>
<tr>
<th>ID</th>
<th>Name</th>
<th>Size</th>
<th>Entity Set</th>
<th>Address</th>
<th>Number</th>
<th>Check</th>
<th>Domain</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Name 1</td>
<td>1234</td>
<td>Entity Set 1</td>
<td>Address 1</td>
<td>Number 1</td>
<td>Check 1</td>
<td>Domain 1</td>
</tr>
<tr>
<td>2</td>
<td>Name 2</td>
<td>5678</td>
<td>Entity Set 2</td>
<td>Address 2</td>
<td>Number 2</td>
<td>Check 2</td>
<td>Domain 2</td>
</tr>
</tbody>
</table>
Entities

- Entity
- Entity sets
- Attributes
- Domains

Relationships

- An association b/w at least two entities
  - Descriptive attributes
  - Instance
Relationships

• Ternary Relationship Set

Employee

\( \text{ssn} \) \( \text{name} \) \( \text{bdate} \) \( \text{Works_in} \) \( \text{Budget} \) \( \text{dname} \) \( \text{since} \) Departments

Locations

\( \text{address} \) \( \text{capacity} \)

Relationships

• Roles Relationship Set
  -- Roles indicator

Employee

\( \text{ssn} \) \( \text{name} \) \( \text{bdate} \)

Subordinate \( \text{Reports_to} \) \( \text{Supervisor} \)

Questions?