CS 445
Introduction to Database Design
E-R Diagrams

Chapter 2

August 31, 2011

Design Steps

- ## Read Chapter 2

  - homework: page 52: 2.2 (1-5) (Due Sept 9)

- ## How do we model the data?

  - what do we need to identify?

Design Steps

- Requirement Analysis

  - talk to the user!

- Conceptual Database Design

  - E-R Diagram

- Logical Database Design

  - logical schema

- Schema Refinement

  - normalization

- Physical Database Design

  - performance tuning

- Application and Security Design

  - GUI / end user software

Bits of Data

- Entity
  - some particular object in the real world

- Entity Set

- Attribute
  - domain
  - key
  - candidate key
  - primary key

Doing interesting things with data

- Relationship

  - association among two or more entities

- Relationship Set

- Descriptive attribute

- Roles

Constraints

- What limits are placed on how entities are involved in a relationship

    - Key Constraints

        - One to many

        - Many to many

        - One to one

    - Participation Constraints

Weak Entities

- Entities without keys!

- Identifying owner

- Identifying relationship

Class Hierarchy

- Some entities may be related
    - similar to Object Oriented class hierarchy
    - C++/Java
    - superclass
    - specialized subclasses

- Inheritance
    - ISA

- Overlap constraints

Aggregation

- View a set of entities/relationships as one big entity
    - meta-entity

How do we use all this?

- When do we use an entity vs an attribute to represent data?

    - it all depends on how you want to use the data

    - how many other bits of data will reference it?

    - how will they reference it?

        - will our model allow that?

- Example: Name and Address

How do we use all this?

- When do we use an entity vs a relationship?

Tool Support

- E-R diagram builders
  - Microsoft Visio
  - MySQL Workbench

- Unified Modeling Language (UML)
  - used to model all kinds of data interactions
  - Object Oriented code design   (Class diagrams)
  - database design
    - think of entities and relationships as classes
  - Use cases (process flow)
  - http://argouml.tigris.org
  - http://argouml-sql.tigris.org

Some tools generate database tables/ queries for you.

Key Constraints

- emp MANAGES dept

- each emp can manage more than one dept

- each dept is managed by only one emp

  - Each dept key appears in ONE MANAGES relationship

  - ONE TO MANY

  - one employee can be associated with MANY depts

  - each dept associated with ONE emp

  - what if each emp ONLY managed ONE dept? (ONE TO ONE)

- emp WORKSIN dept

  - each emp can work in several depts

  - each dept has several emp

  - MANY TO MANY

  - what is each emp worked in only one DEPT?

Ramakrishnan/Gehrke: Page 52

Exercise 2.3 Consider the following information about a university database:

- Professors have an SSN, a name, an age, a rank, and a research specialty.

- Projects have a project number, a sponsor name (e.g., NSF), a starting date, an ending date, and a budget.

- Graduate students have an SSN, a name, an age, and a degree program (e.g., M.S. or Ph.D.).

- Each project is managed by one professor (known as the project's principal investigator).

- Each project is worked on by one or more professors (known as the project's co-investigators).

- Professors can manage and/or work on multiple projects.

- Each project is worked on by one or more graduate students (known as the project's research assistants).

- When graduate students work on a project, a professor must supervise their work on the project. Graduate students can work on multiple projects, in which case they will have a (potentially different) supervisor for each one.