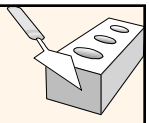
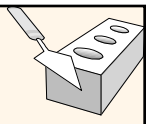


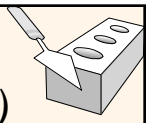
Introduction to Database Design

Chapter 2



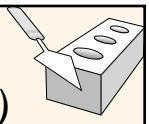
Overview of Database Design

- *Requirements Analysis*
  - The very first step in designing a database application.
  - We focus on the design of the database.
- *Conceptual design*: *(ER Model is used at this stage.)*
  - What are the *entities* and *relationships* in the enterprise?
  - What information about these entities and relationships should we store in the database?
  - What are the *integrity constraints* or *business rules* that hold?



Overview of Database Design (Cont.)

sid	name	login	age	gpa
53666	Jones	jones@cs	18	3.4
53688	Smith	smith@ee	18	3.2



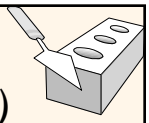
Overview of Database Design (Cont.)

- A database `schema' in the ER Model can be represented pictorially (*ER diagrams*).

❖ *Logical Database Design*

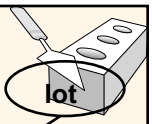
- Choose a DBMS to implement our database design.
- Map an ER diagram into a relational schema (Chapter 3).

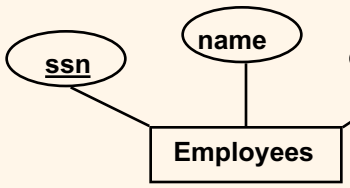
Overview of Database Design (Cont.)



- *Schema Refinement* (Chapter 19)
  - Analyze the current schema to identify potential problems and to refine it (performance criteria).
  - Theory – *normalizing relations*.
- *Physical Database Design* (Chapter 20)
  - Build indices on some tables and clustering some tables.
- *Application and Security Design* (Chapter 21)
  - Consider aspects of the application that go beyond the database itself.

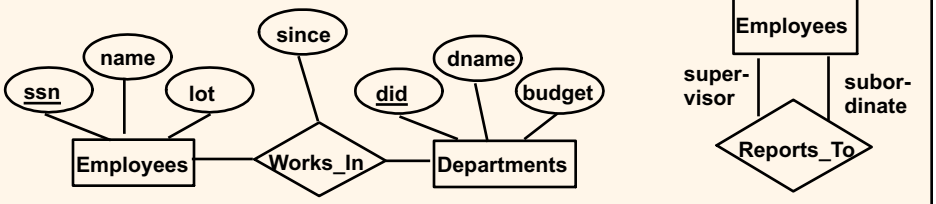
ER Model Basics





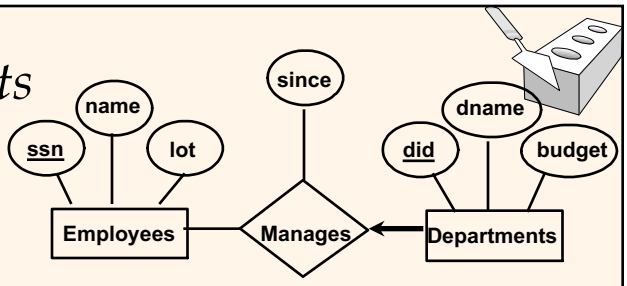
- *Entity:* Real-world object distinguishable from other objects. An entity is described (in DB) using a set of *attributes*.
- *Entity Set*: A collection of similar entities. E.g., all employees.
  - All entities in an entity set have the same set of attributes. (Until we consider ISA hierarchies, anyway!)
  - Each entity set has a *key (primary key - SSN)*.
  - Each attribute has a *domain*.

ER Model Basics (Contd.)

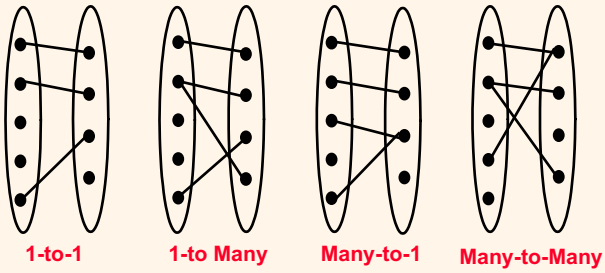


- *Relationship*: Association among two or more entities. E.g., Barbara works in the CS department.
- *Relationship Set*: Collection of similar relationships.
  - An n-ary relationship set R relates n entity sets E1 ... En; each relationship in R involves entities e1 ∈ E1, ..., en ∈ En
    - Same entity set could participate in different relationship sets, or in different "roles" in same set.

Key Constraints

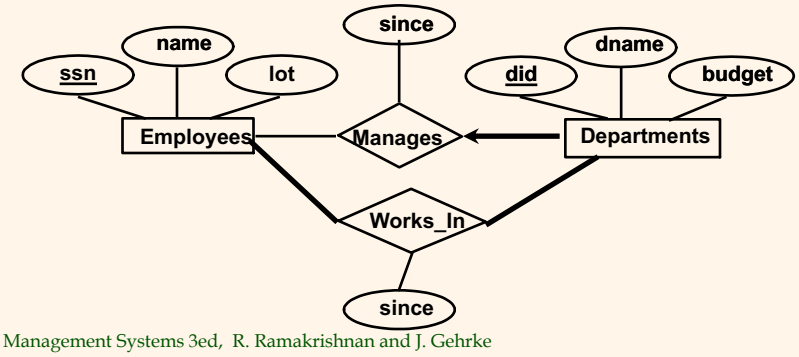


- Consider Works_In: An employee can work in many departments; a dept can have many employees.
- In contrast, each dept has at most one manager, according to the *key constraint* on Manages.



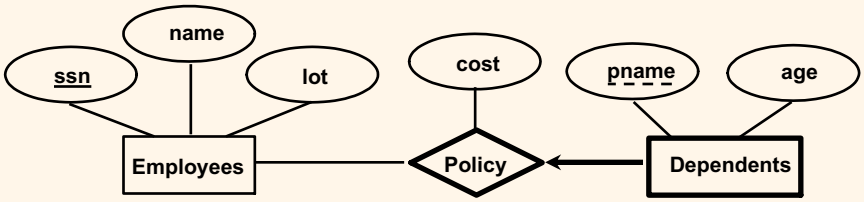
Participation Constraints

- Does every department have a manager?
  - If so, this is a *participation constraint*: the participation of Departments in Manages is said to be *total* (vs. *partial*).
    - Every Departments entity must appear in an instance of the Manages relationship.

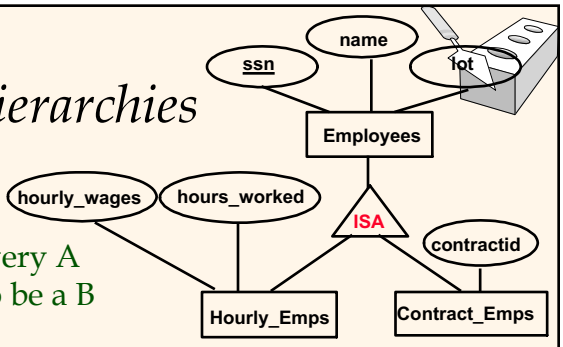


Weak Entities

- A *weak entity* can be identified uniquely only by considering the primary key of another (*owner*) entity.
  - Owner entity set and weak entity set must participate in a ***one-to-many*** relationship set (one owner, many weak entities).
  - Weak entity set must have ***total participation*** in this *identifying* relationship set.
  - Identifying owner (the way to identify a weak entity) – SSN + pname (*partial key*).



ISA (`is a') Hierarchies



- As in C++, or other PLs, attributes are inherited.
- If we declare A **ISA** B, every A entity is also considered to be a B entity.
  - Reasons for using ISA:
    - To add descriptive attributes specific to a subclass.
    - To identify entitities that participate in a relationship.
  - *Overlap constraints*: Can Joe be an Hourly_Emps as well as a Contract_Emps entity? (*Allowed/disallowed*) *No by default*
  - *Covering constraints*: Does every Employees entity also have to be an Hourly_Emps or a Contract_Emps entity? *(Yes/no) No by default*