Introduction to Database System
Entity Relationship Model

Database Design

- **Phase 1**: Requirement Analysis
  - What users (apps) expects from the database

- **Phase 2**: Conceptual Database Design
  - Build ER (Entity-Relationship) diagram

- **Phase 3**: Logical Database Design
  - Convert ER design into a *relational* database schema

Overview of 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?
  - A database 'schema' in the ER Model can be represented pictorially (*ER diagrams*).
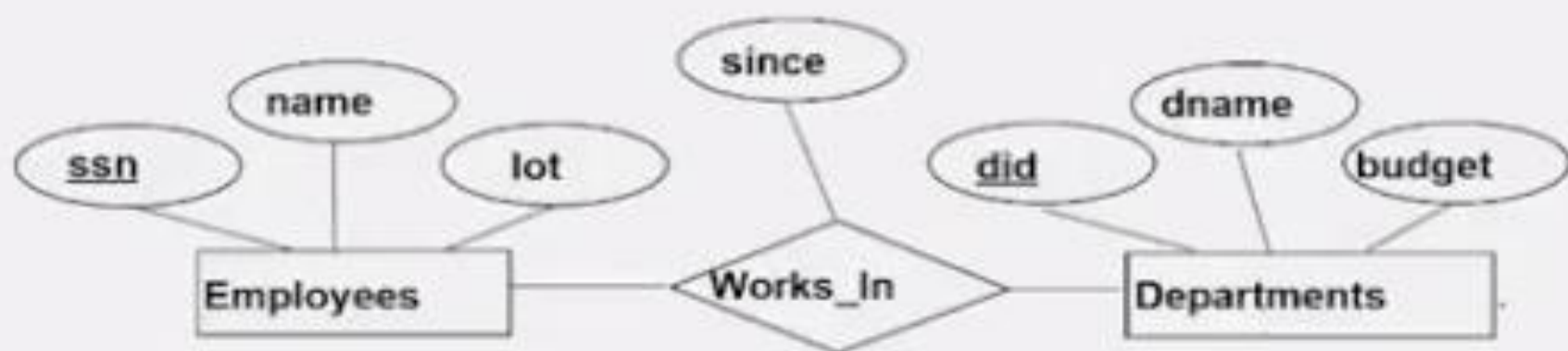 - Can map an ER diagram into a relational schema.

ER Model Basics (1/2)

- *Entity*: Real-world object distinguishable from other objects. An entity is described 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.
  - Each entity set has a *key*.
  - Each attribute has a *domain*.

ER Model Basics (2/2)
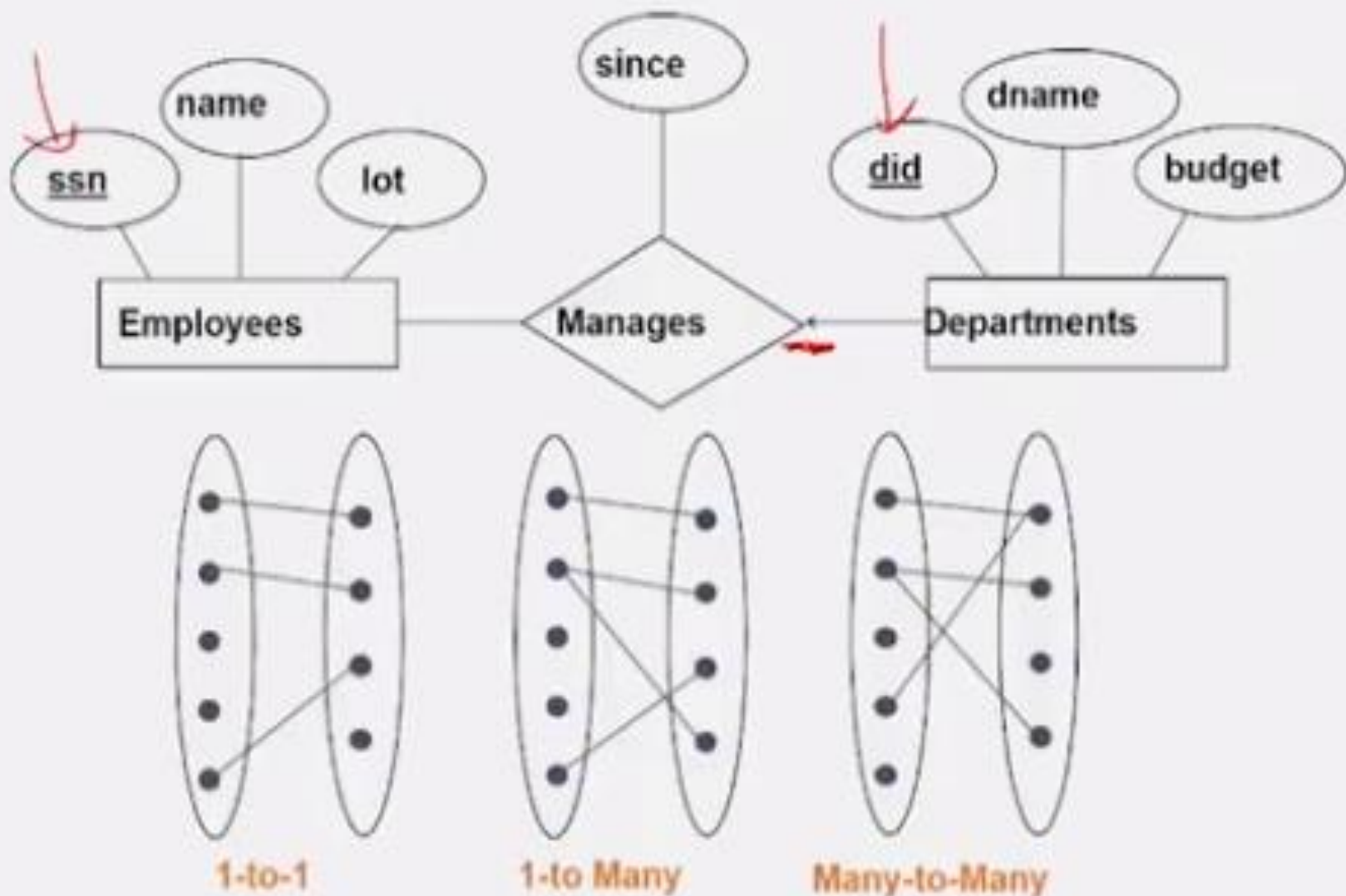

- *Relationship*: Association among 2 or more entities.
  - E.g., Alice works in Pharmacy department.
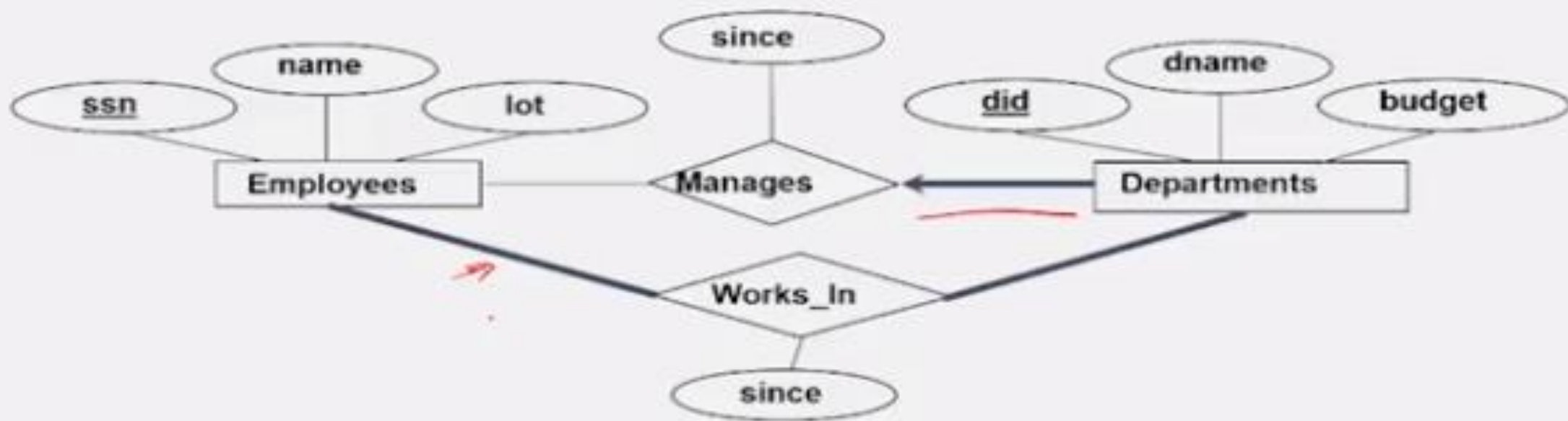- *Relationship Set*: Collection of similar relationships.

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.

1-to-1   1-to Many   Many-to-Many

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.