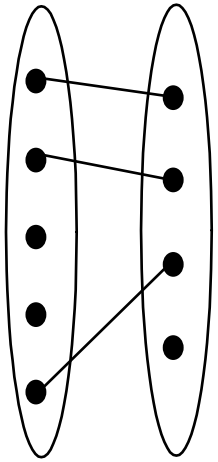
The Entity-Relationship Model (Part III)

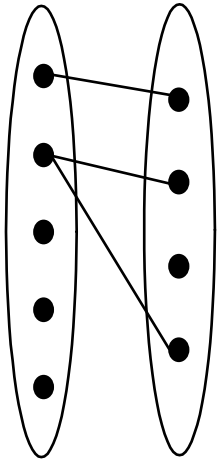
R &G - Chapter 2

Review: ER Model

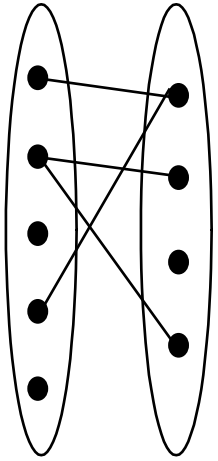
- **Basic issues in ER design**
  - Entities and entity set
  - Relationships and relationship sets
  - Keys
  - Cardinality constraints on relationships (1:1, 1:M, M:N)



1-to-1

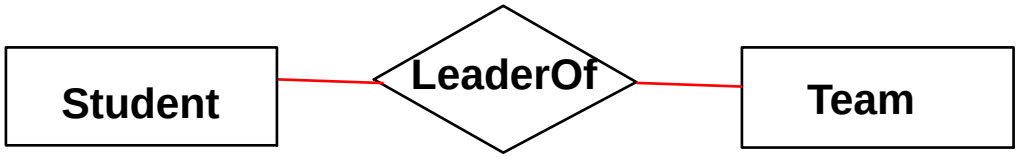


1-to-Many



Many-to-Many

Exercise: Cardinality Constraints



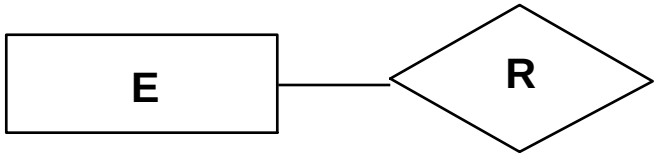
- Consider following facts:
  - Each team can only have 1 leader;
  - Each student can be the leader of multiple teams
  - What's the cardinality constraint of the *LeaderOf* relationship? How to draw it in the ER diagram?
- Now the facts are changed to be following:
  - Each team can have multiple leaders,
  - Each student can be the leader of at most 1 team
  - What's the cardinality constraint of the *LeaderOf* relationship? How to draw it in the ER diagram?

Today's Lecture

- **Constraints** on ER diagram
  - Cardinality constraints
  - Participation constraint
  - Weak entity set

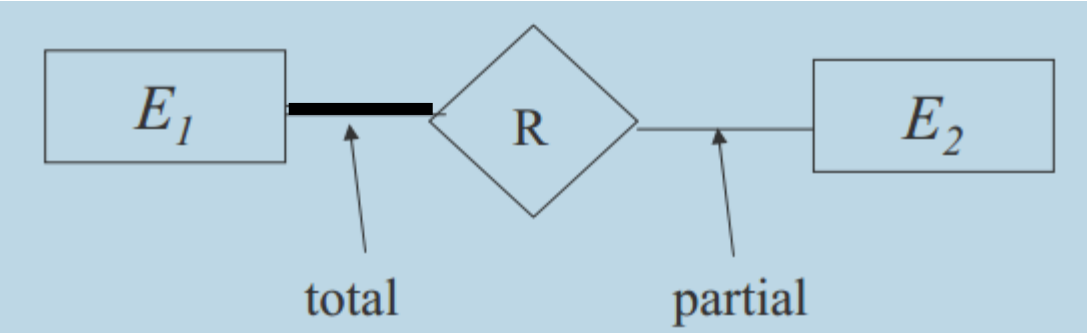
Participation Constraints

- An entity set E may participate in a relation R either *totally* or *partially*.
  - **Total participation**: Every entity in E is involved in the relationship R.
  - **Partial participation**: Not all entities in E are involved in the relationship R.



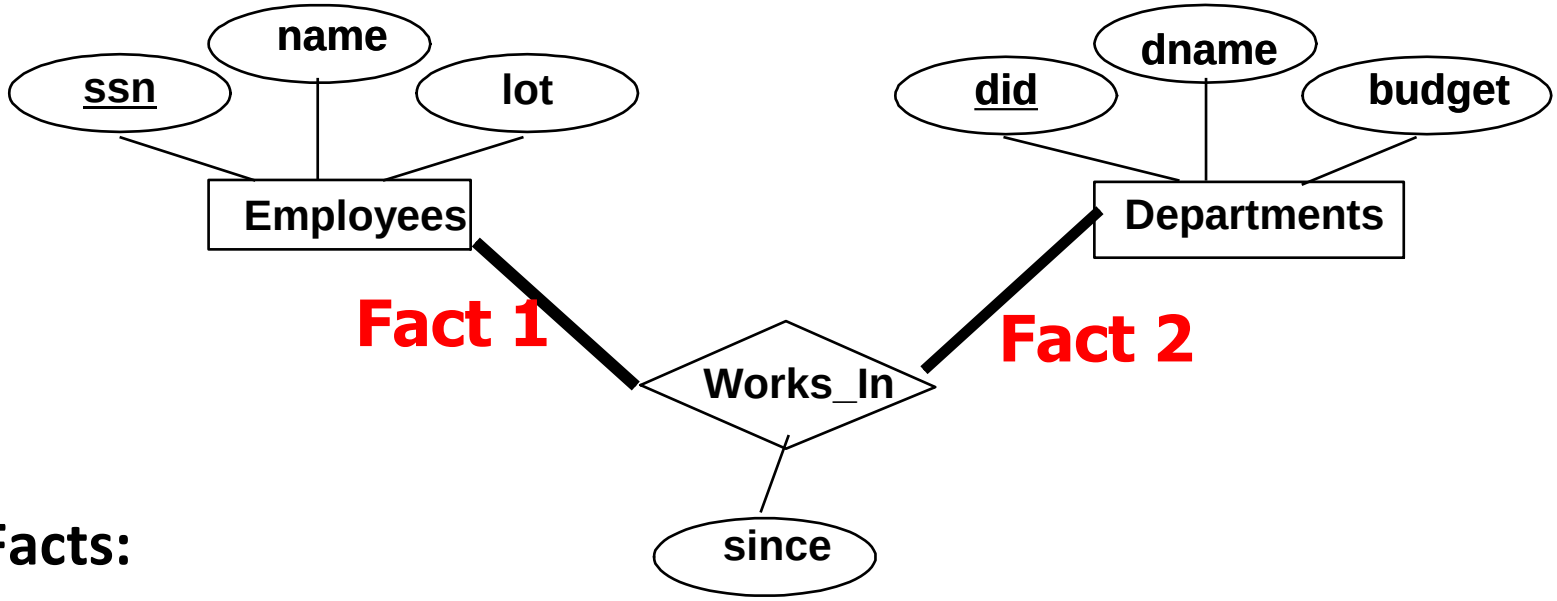
Draw Total Participation Constraint in ER Diagram

- **Total participation is represented in bold line.**



Participation constraints in ER diagrm

Example: Total Participation



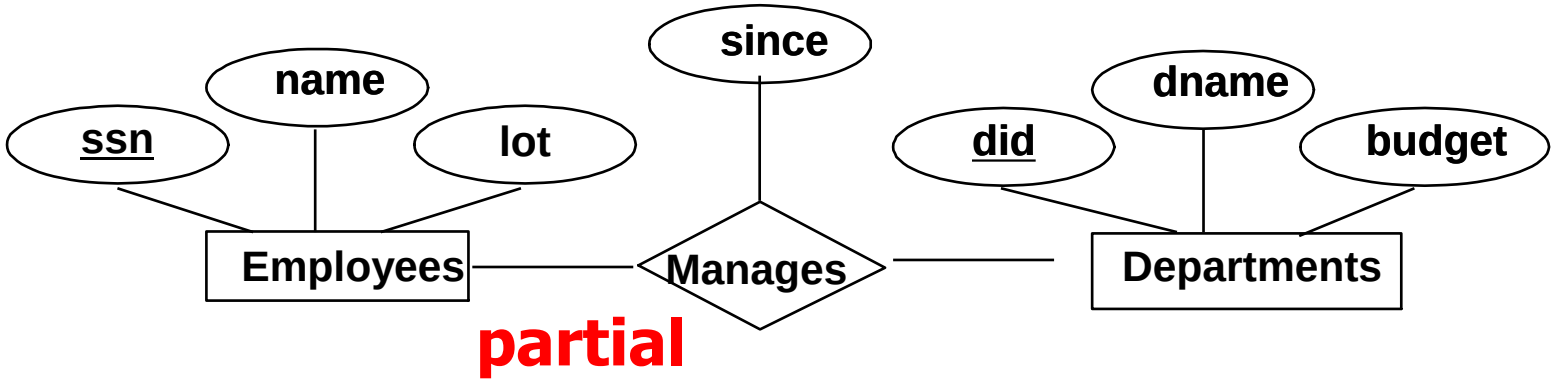
- **Facts:**

  Fact 1: Each employee works in at least one department

  Fact 2: Each department has at least one employee

- **What are the participation constraints? How to draw these constraints in the ER diagram?**

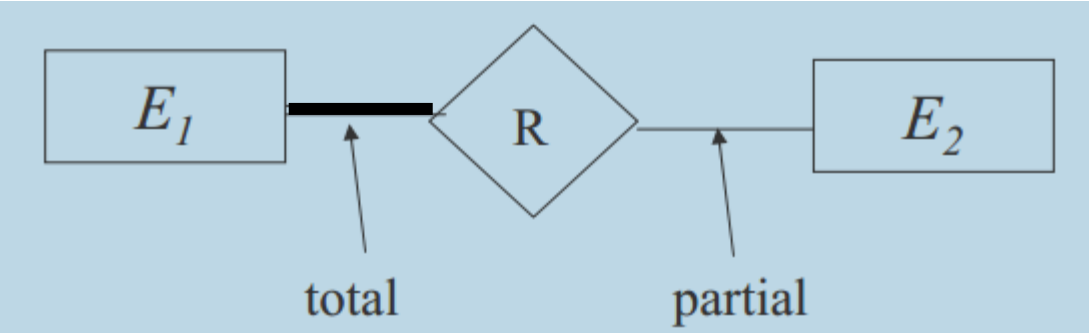
Example: Partial Participation



- **Fact:**
  - Not every employee manages a department
- **So this is a *partial participation* between Employees and Manages**

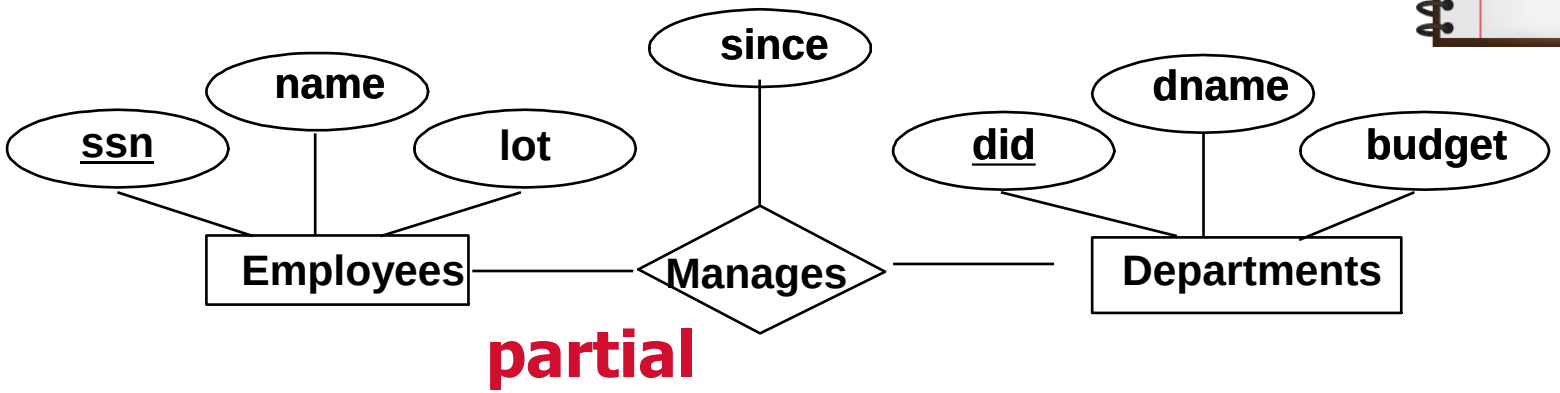
Represent Partial Participation in ER Diagram

- **No-op for partial participation**
  - Regular line
  - No need to write "partial/total" underneath the line



Participation constraints in ER diagrm

Exercise: Participation constraint



- **Consider an additional fact for the previous example**
  - Fact: every department must have a manager.
  - How to represent the participation constraint in the ER diagram above?

Today's Lecture

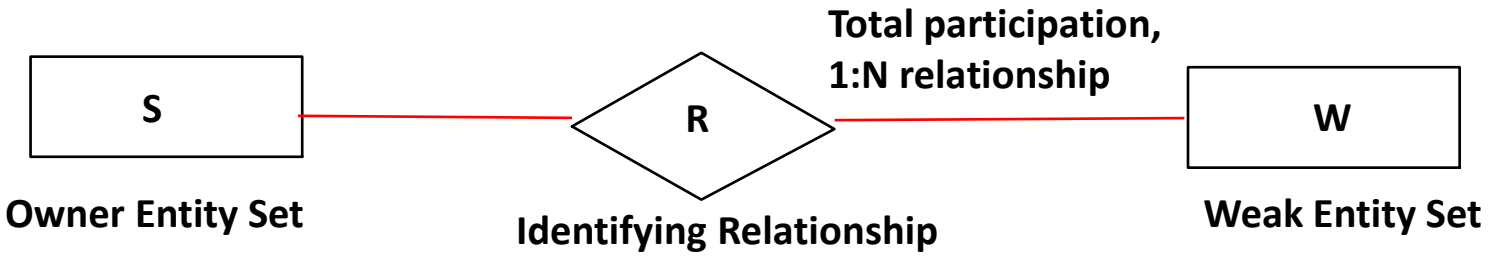
- **Constraints** on ER diagram
  - Participation constraint
  - Weak entity set

Strong and Weak Entities

- Some entities exist independently.
  - E.g., *Student* entity;
  - These entities are **strong.**
- Some entities depend on other entities
  - The *team* entity depends on the existence of *LabSession* entity.
  - These entities are **weak**.

Weak Entity Set

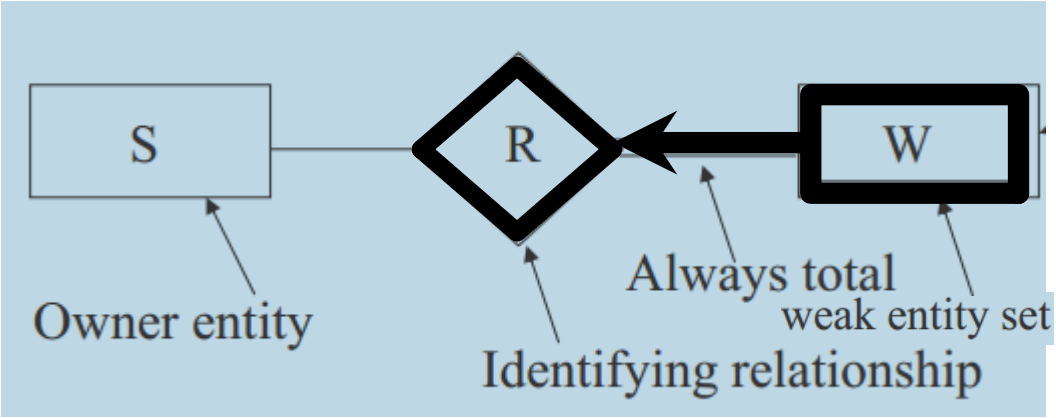
- Weak entity set: An entity set cannot exist by itself. Its entities owe their existence to some entity in a strong entity set.
  - *Owner entity set:* the strong entity.
  - *Identifying relationship*: the relationship between owner and weak entity sets.
  - Weak entities must relate to the owner entity via a ***total participation, one-to-many*** relationship set
    - With the weak entity set at the many-side.



Draw Weak Entity Sets in ER Diagram

Take *ALL four* actions below:

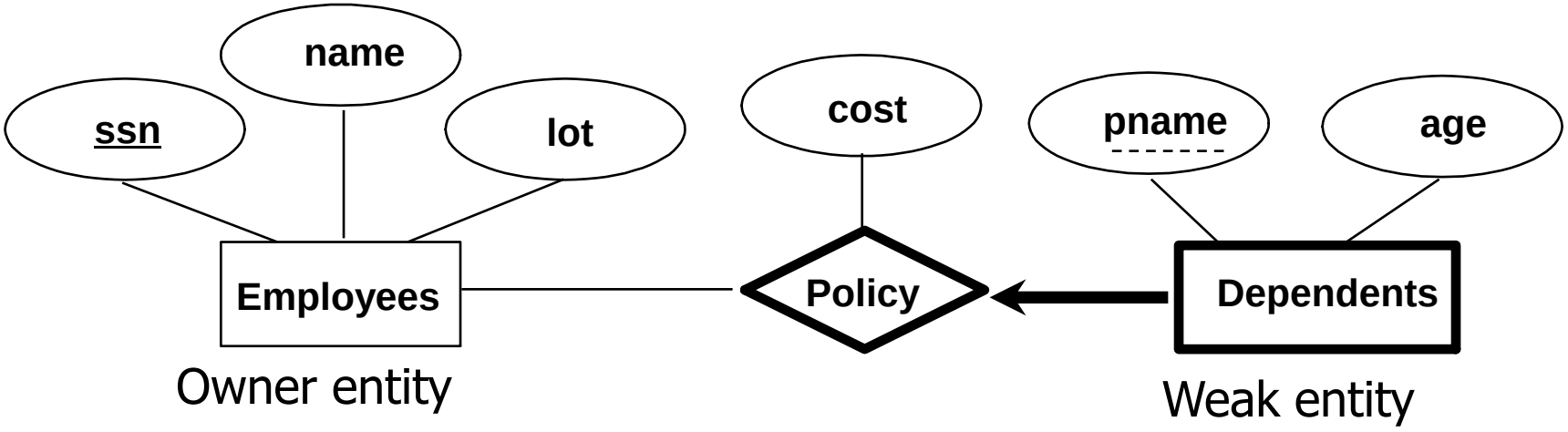
1. Weak entity set W: draw rectangle in **bold line**
2. Identifying relationship R: draw diamond in **bold lin**e
3. Draw a **bold line** connecting R and W (total participation)
4. Add an arrow on the line that connects R and W, with the arrow pointing to R (one-to-many relationship)



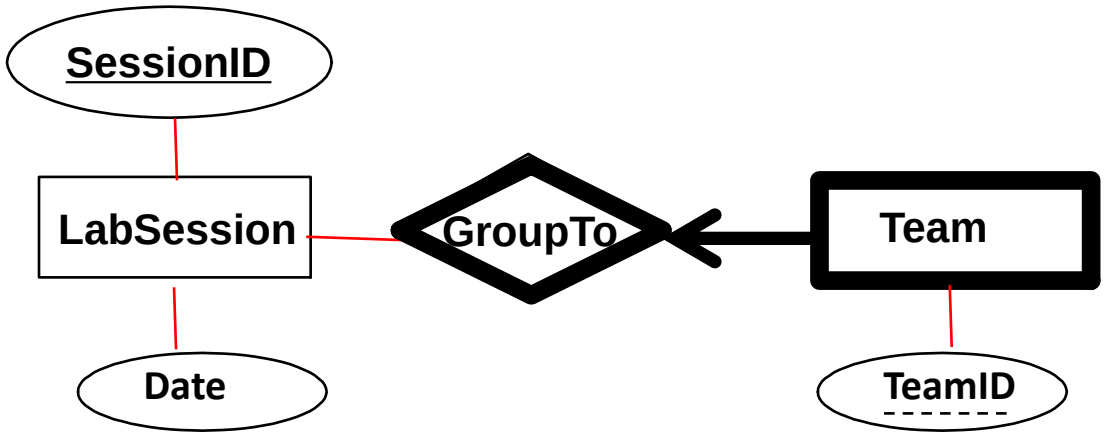
Weak entity set in ER diagram

Key of Weak Entity Set

- A weak entity set never has a key
  - Example: *pname* cannot be used as the key of *Dependents*
- It only has a "partial key" (dashed underline in ER)
  - It consists of primary key of the owner entity + partial key of itself
    - *Example: Key of Dependents entity: (ssn, pname)*

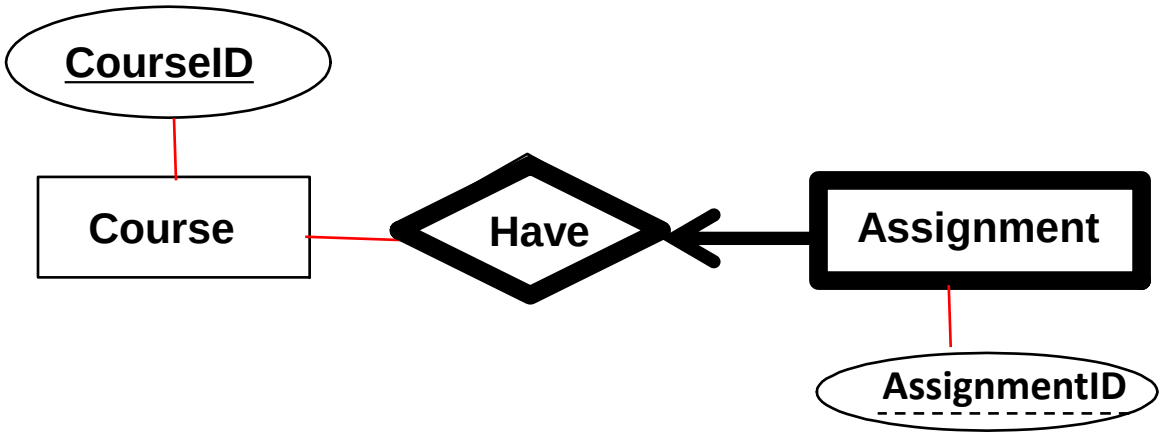


Exercise 1: Key of Weak Entity Set



- What's the key of *Team* entity?

Exercise 2: Key of Weak Entity Set



- What's the key of *Assignment*?

Exercise

- **Facts:**
  - The university provides several courses, each course has its name, unique ID (e.g., CS442, CS392, etc.), and the number of credits.
  - Each course can have several sections. Each section has its own ID (e.g, A, B, etc.), classroom, instructor, and meeting times.
  - The sections of different courses may have the same ID (e.g, both CS442 and CS392 have Section A).
- **Question**:
  - Design the ER diagram of the ***course*** and ***section*** entity sets, and the relationship between them.