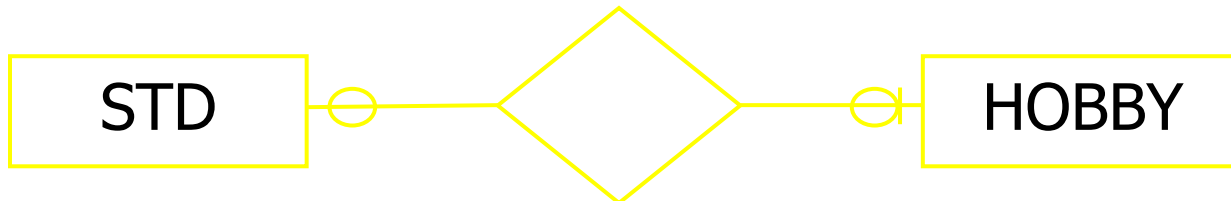
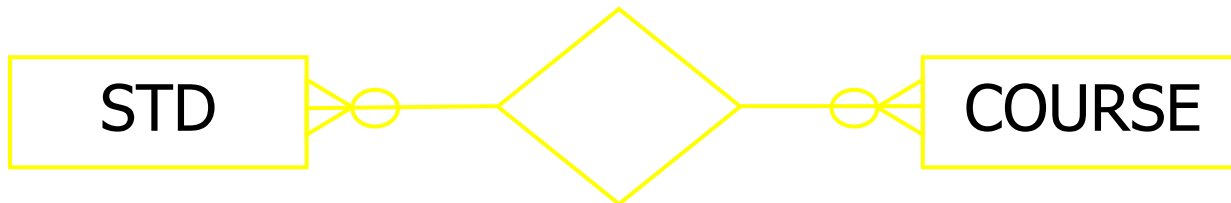
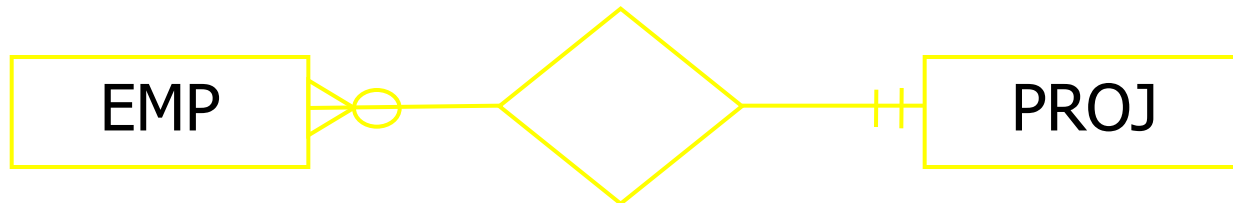
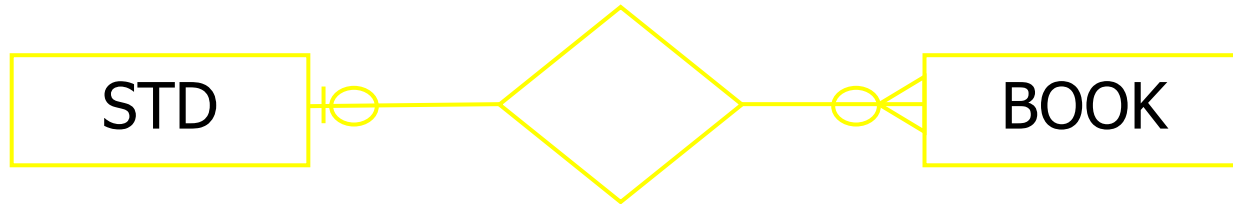


# Introduction to Database Systems

## Lecture 6

Engr. Madeha Mushtaq  
Department of Computer Science  
Iqra National University

# Cardinality Example



# Other Notations



# Participation Constraints

- The participation constraint specifies whether the existence of an entity depends on its being related to another entity via the relationship type.
- This constraint specifies the minimum number of relationship instances that each entity can participate in, and is sometimes called the minimum cardinality constraint.

# Participation Constraints

- There are two types of participation constraints - Total and Partial.
- Example:
- If a company policy states that *every* employee must work for a department, then an employee entity can exist only if it participates in at least one WORKS\_FOR relationship instance.
- Thus, the participation of EMPLOYEE in WORKS\_FOR is called total participation, meaning that every entity in *the total set* of employee entities must be related to a department entity via WORKS\_FOR.
- Total participation is also called existence dependency.

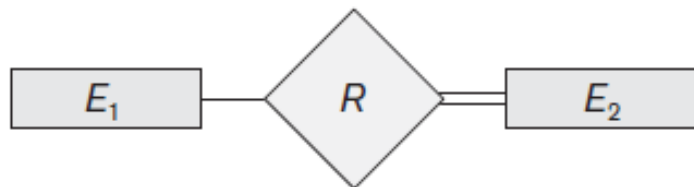
# Participation Constraints

- MANAGES relationship type is partial as we do not expect every employee to manage a department.
- Meaning that some or part of the set of employee entities are related to some department entity via MANAGES, but not necessarily all.
- We can refer to the cardinality ratio and participation constraints, taken together, as the structural constraints of a relationship type.

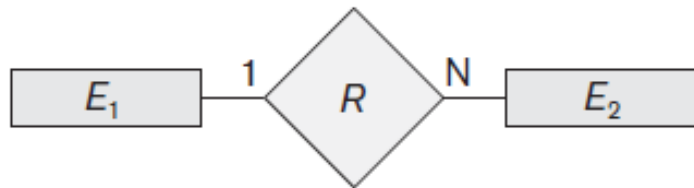
# Participation Constraints

- In ER diagrams, total participation (or existence dependency) is displayed as a double line connecting the participating entity type to the relationship, whereas partial participation is represented by a single line.

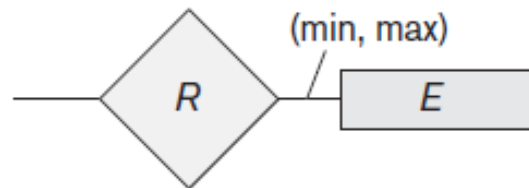
# Participation Constraints



Total Participation of  $E_2$  in  $R$



Cardinality Ratio 1: N for  $E_1:E_2$  in  $R$



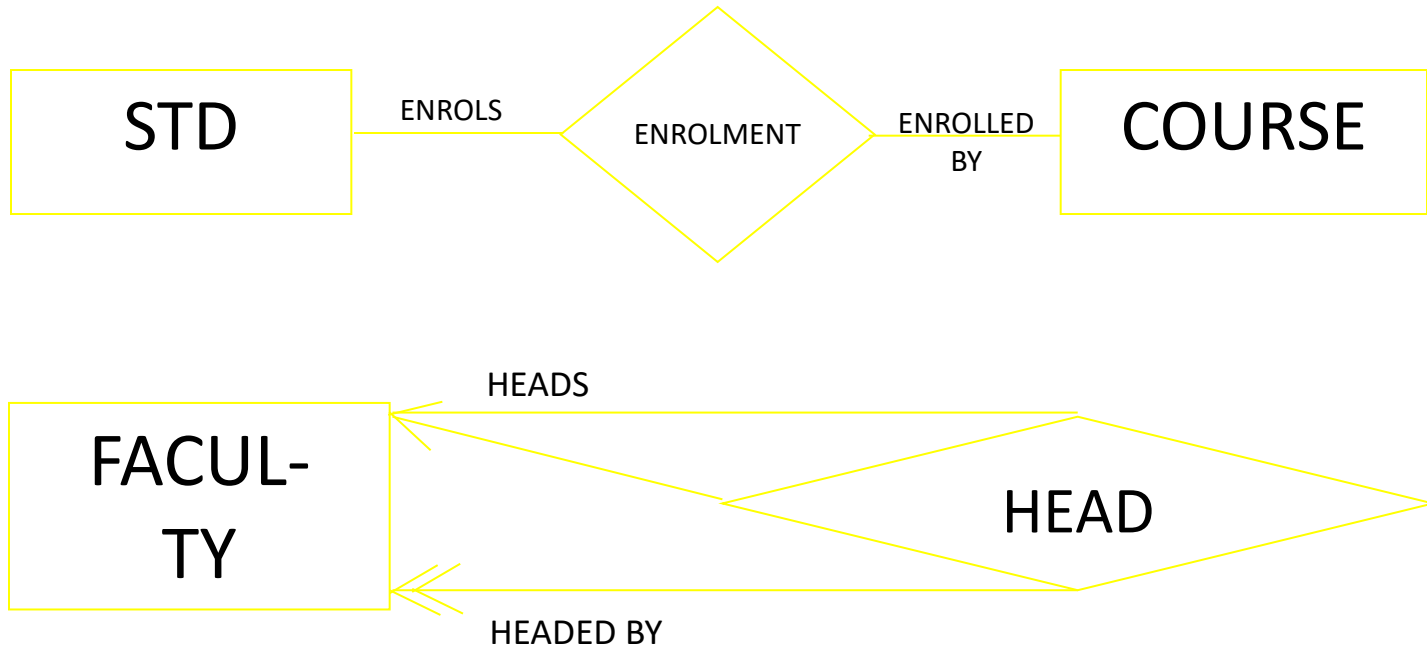
Structural Constraint (min, max)  
on Participation of  $E$  in  $R$



# Roles in Relationships

- Determine the roles ETs play in a relationship.
- Most of the time it is clear from the context, like in STD and COURSE relationship.
- Two situation when they should be expressed explicitly:
  - A one to one relationship
  - Two ETs having more than one relationship

# Roles Examples



# Refined ER Design for the COMPANY Database

- We can now refine the database design by changing the attributes that represent relationships into relationship types.
- Also we will present the cardinality ratio and participation constraint of each relationship type.
- In our example, we specify the following relationship types:
- **MANAGES**, a 1:1 relationship type between EMPLOYEE and DEPARTMENT.

# Refined ER Design for the COMPANY Database

- EMPLOYEE participation is partial. DEPARTMENT participation is not clear from the requirements. We question the users, who say that a department must have a manager at all times, which implies total participation.
- **WORKS\_FOR**, a 1:N relationship type between DEPARTMENT and EMPLOYEE.
- Both participations are total.

# Refined ER Design for the COMPANY Database

- **CONTROLS**, a 1:N relationship type between DEPARTMENT and PROJECT.
- The participation of PROJECT is total, whereas that of DEPARTMENT is determined to be partial, after consultation with the users indicates that some departments may control no projects.

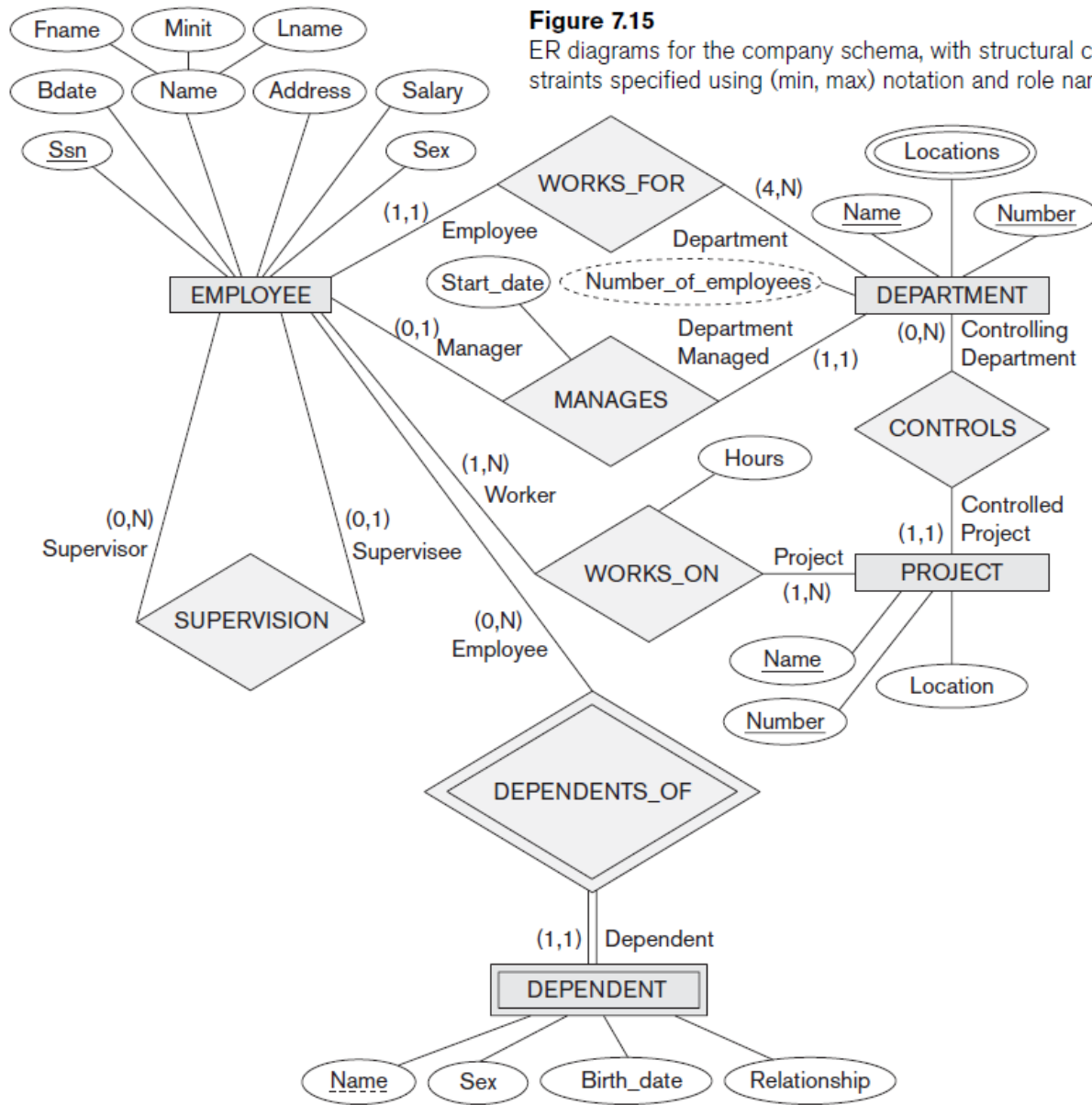
# Refined ER Design for the COMPANY Database

- **SUPERVISION**, a 1:N relationship type between EMPLOYEE (in the supervisor role) and EMPLOYEE (in the supervisee role).
- Both participations are determined to be partial, after the users indicate that not every employee is a supervisor and not every employee has a supervisor.
- **WORKS\_ON**, determined to be an M:N relationship type with attribute Hours, after the users indicate that a project can have several employees working on it.

# Refined ER Design for the COMPANY Database

- Both participations are determined to be total.
- **DEPENDENTS\_OF**, a 1:N relationship type between EMPLOYEE and DEPENDENT, which is also the identifying relationship for the weak entity type DEPENDENT.
- The participation of EMPLOYEE is partial, whereas that of DEPENDENT is total.

# Refined ER Design for the COMPANY Database



**Figure 7.15**

ER diagrams for the company schema, with structural constraints specified using (min, max) notation and role names.



End of Slides