

# Introduction to Database Systems

## Lecture 5

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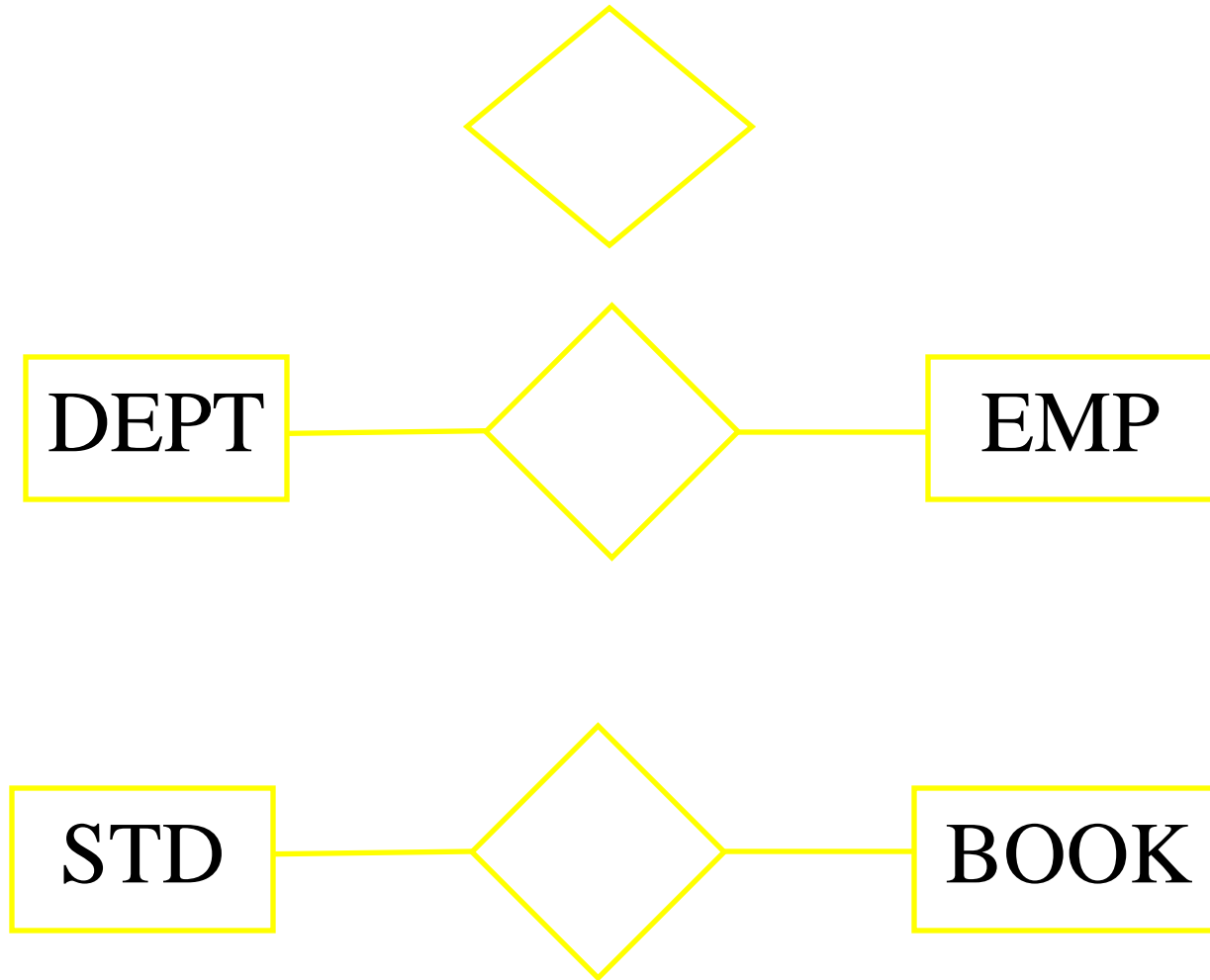
# Relationships

- Relationships are the connections and interactions between the entities instances, e.g., Program and Student ETs are linked.
- If there is no proper name of the association in the system then participants' names or abbreviations are used.
- STUDENT and CLASS have ENROLL relationship.
- However, it can also be named as STD\_CLS.

# Relationships

- Relationship type can be identified like an entity type.
- A relationship type is an abstraction of a relationship.
- Entities involved in a relationship are called its participants.
- Types of the relationships can be established on the basis of participant ETs.

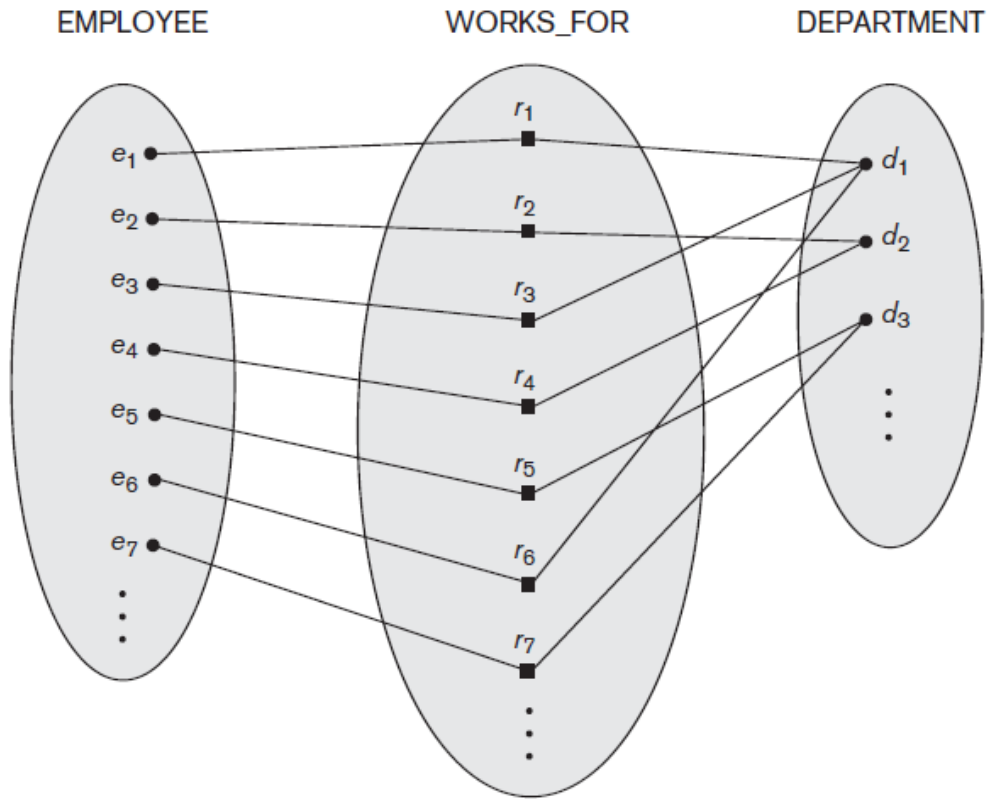
# Symbol for Relationships



# Relationship Example

- Consider the relationship type WORKS\_FOR between the two entity types EMP and DEPT.
- It associates each employee with the department for which the employee works in the corresponding entity set.
- Each relationship instance in the relationship set WORKS\_FOR associates one EMP entity and one DEPT entity.

# Relationship Example



# Relationship Example

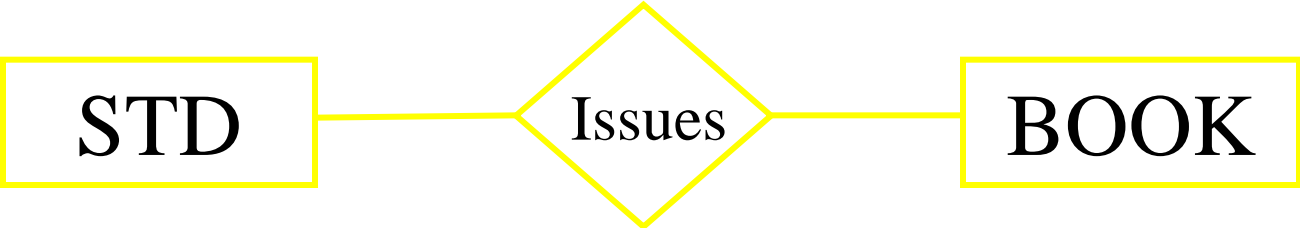
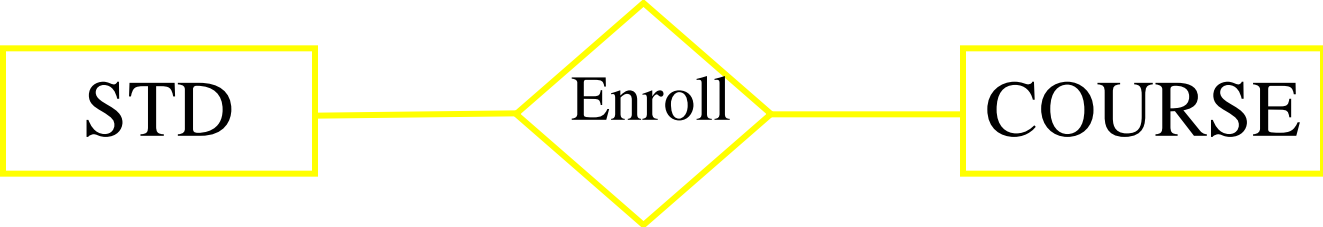
- Figure above illustrates the example, where each relationship instance  $ri$  is shown connected to the EMPLOYEE and DEPARTMENT entities that participate in  $ri$ .
- In the mini-world represented by the figure, employees  $e1$ ,  $e3$ , and  $e6$  work for department  $d1$ ;
- Employees  $e2$  and  $e4$  work for department  $d2$ ;
- And employees  $e5$  and  $e7$  work for department  $d3$ .

# Relationships Types

- A Binary relationship is the one that links two entity types e.g. STUDENT-CLASS.
- The degree of a relationship type is the number of participating entity types.
- A Binary relationship is thus of degree two.
- May also have instances, that can be formally described in an ordered pair form
- $\{(S1001, OS), (S1020, DS), (S1002, DS), (S1058, NW)\}$



# Binary Relationship



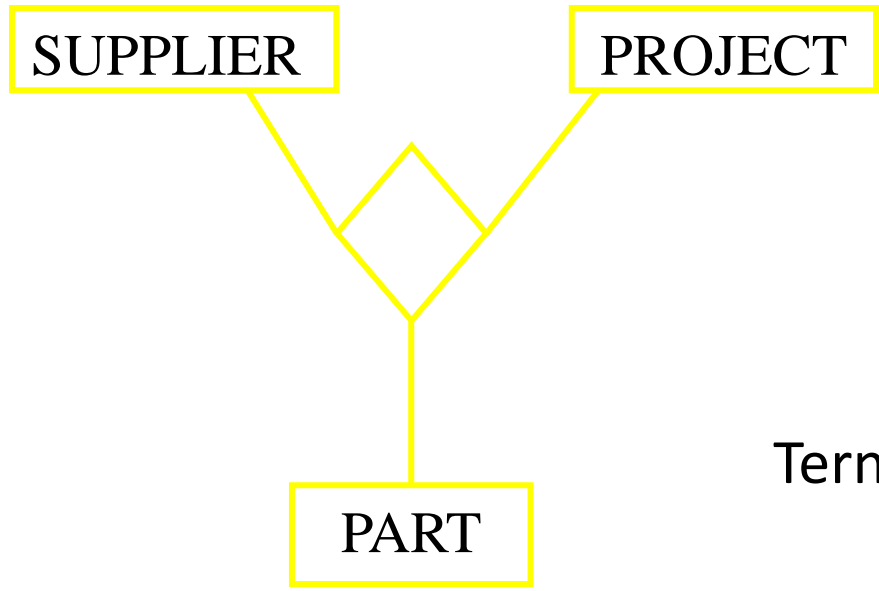
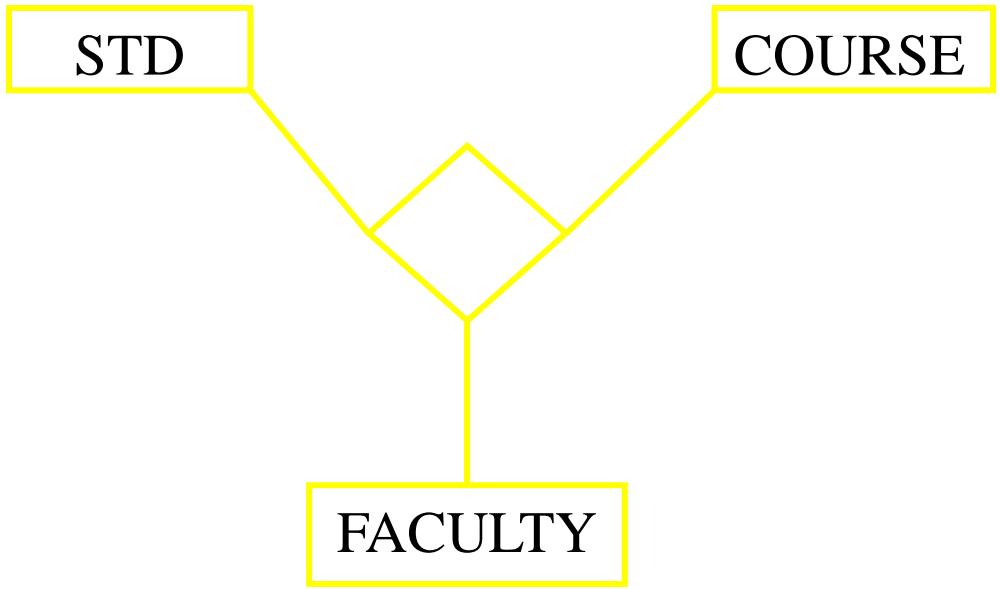
# Ternary Relationship

- One that involves three entity types.
- For Example: STUDENT-CLASS-FACULTY.
- Ternary Relationships are hence of degree three.
- Instances in ordered triples
- Example {(Smith, Nut, Sorter), (Jones, Bolt, Console)}

# Ternary Relationship

- An example of a ternary relationship is SUPPLY, as shown in Figure.
- Here each relationship instance  $ri$  associates three entities—a supplier  $s$ , a part  $p$ , and a project  $j$
- Whenever  $s$  supplies part  $p$  to project  $j$ .





Ternary Relationship  
Examples

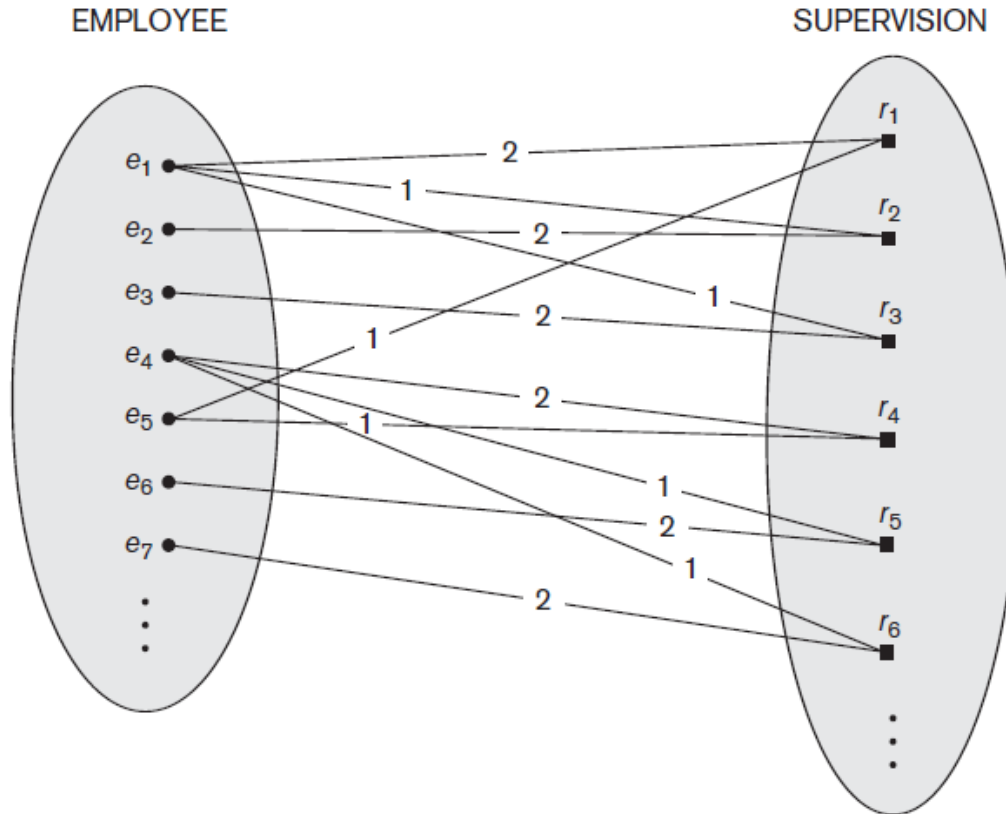
# Unary Relationship

- An ET linked with itself, also called recursive relationship.
- Example Roommate, where STUDENT is linked with STUDENT.
- Another example: The SUPERVISION relationship type relates an employee to a supervisor, where both employee and supervisor entities are members of the same EMPLOYEE entity set.

# Unary Relationship

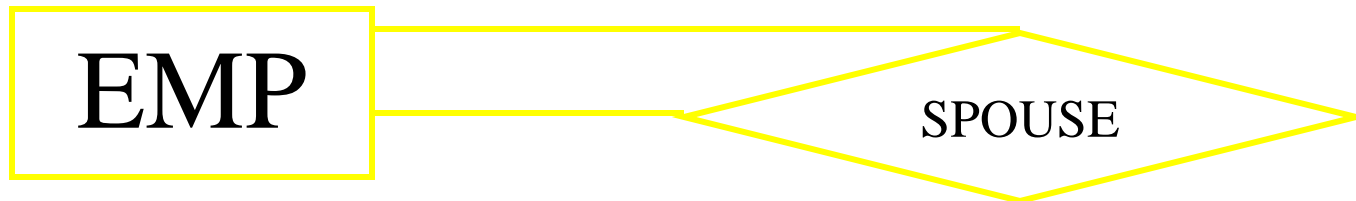
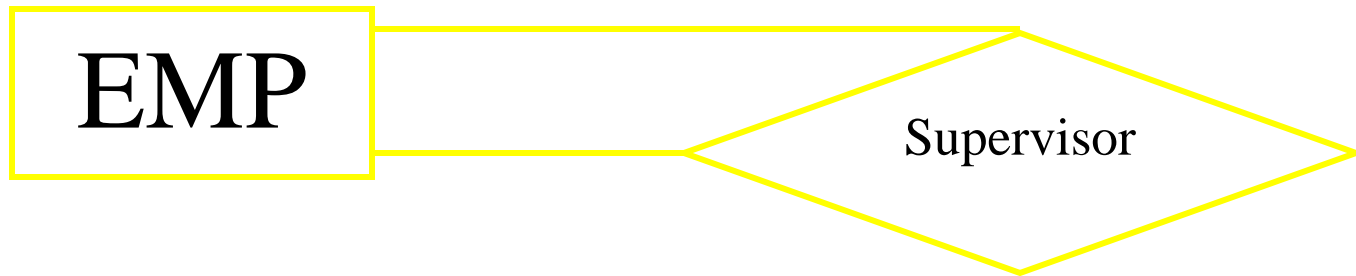
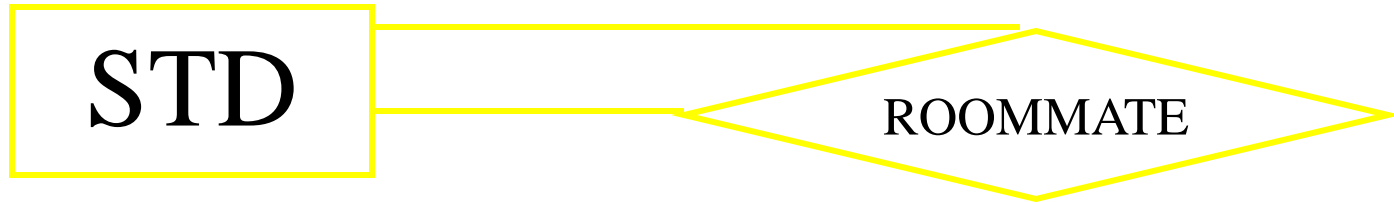
- Each relationship instance  $ri$  in SUPERVISION associates two employee entities  $ej$  and  $ek$ , one of which plays the role of supervisor and the other the role of supervisee.
- In Figure, the lines marked '1' represent the supervisor role, and those marked '2' represent the supervisee role; hence,  $e1$  supervises  $e2$  and  $e3$ ,  $e4$  supervises  $e6$  and  $e7$ , and  $e5$  supervises  $e1$  and  $e4$ .
- In this example, each relationship instance must be connected with two lines, one marked with '1' (supervisor) and the other with '2' (supervisee).

# Unary Relationship





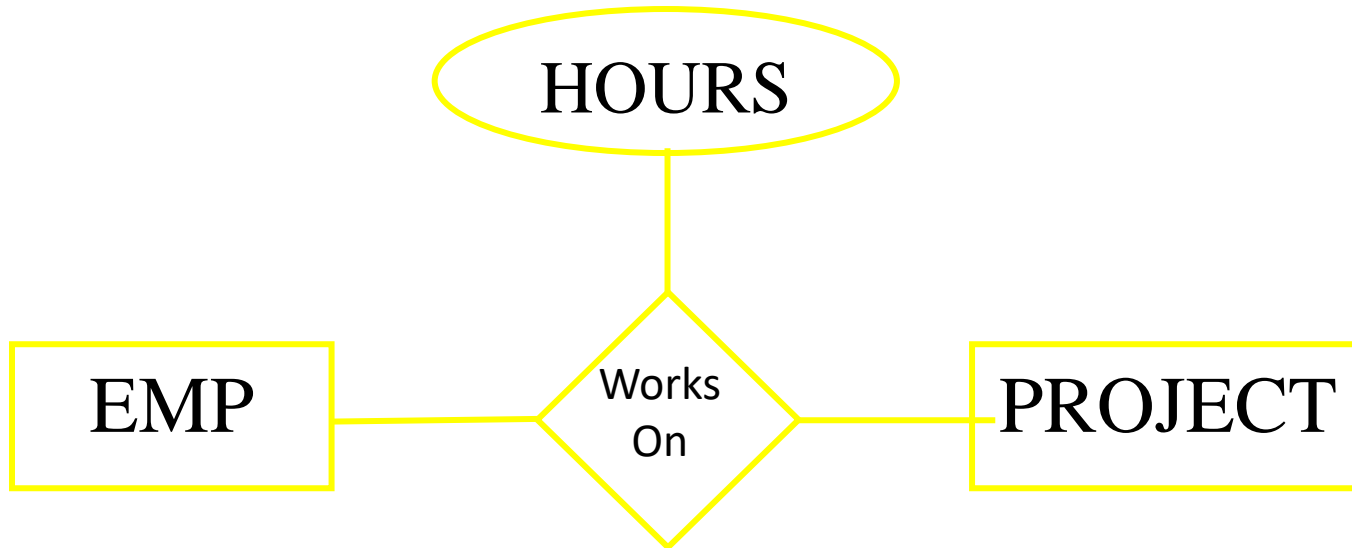
# Unary Relationship Examples



# Attributes of Relationship

- Relationship types can also have attributes, similar to those of entity types.
- For example, to record the number of hours per week that an employee works on a particular project, we can include an attribute Hours for the WORKS\_ON relationship type.
- Another example is to include the date on which a manager started managing a department via an attribute Start\_date for the MANAGES relationship type

# Attributes of Relationship



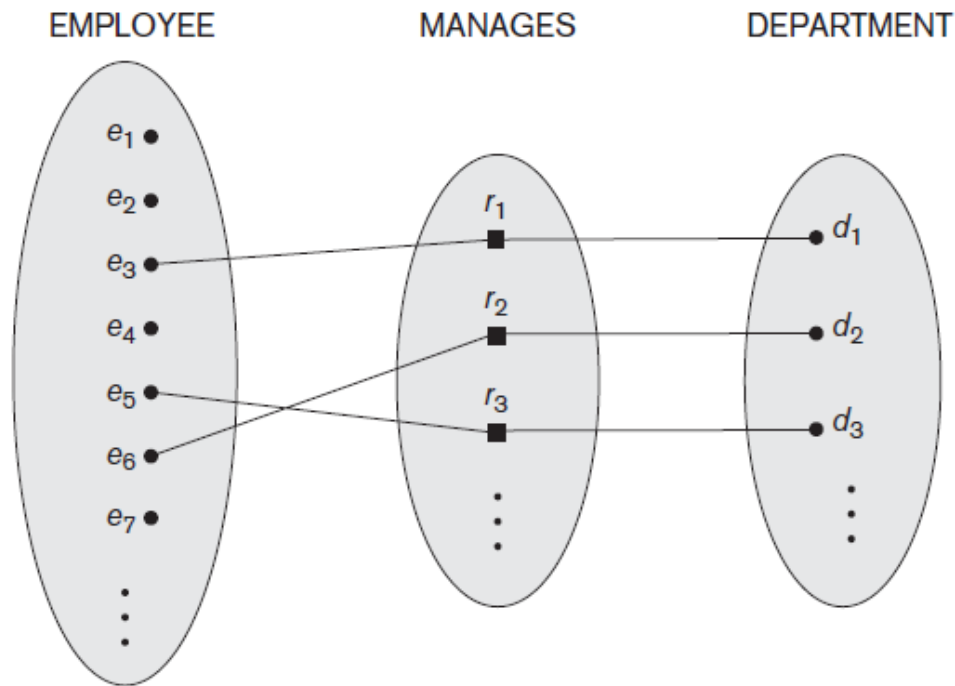
# Cardinality of Relationships

- Number of instances of one entity type that can possibly be related to instances of other entity type.
- The cardinality ratio for a binary relationship specifies the *maximum* number of relationship instances that an entity can participate in.
- For example, in the WORKS\_FOR binary relationship type,
- DEPARTMENT:EMPLOYEE is of cardinality ratio 1:N, meaning that each department can be related to (that is, employs) any number of employees, but an employee can be related to (work for) only one department.

# Cardinality of Relationships

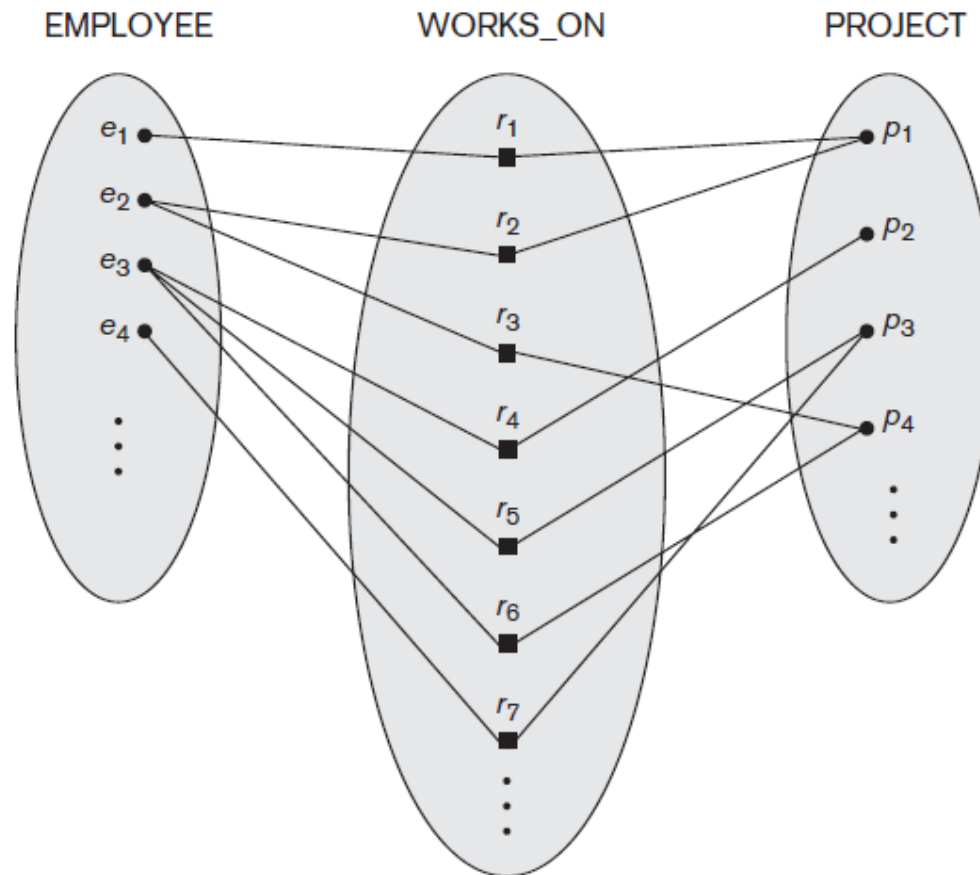
- On the other hand, an employee can be related to a maximum of one department.
- The possible cardinality ratios for binary relationship types are 1:1, 1:N, N:1, and M:N.
- An example of a 1:1 binary relationship is MANAGES which relates a department entity to the employee who manages that department.
- This represents the mini-world constraints that—at any point in time—an employee can manage one department only and a department can have one manager only.

# Cardinality of Relationships



# Cardinality of Relationships

- The relationship type WORKS\_ON is of cardinality ratio M:N, because the mini-world rule is that an employee can work on several projects and a project can have several employees.



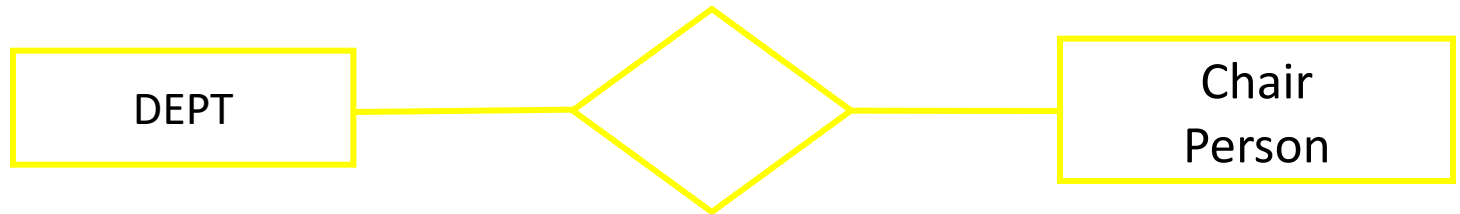
# Types of Cardinalities

- One to one
- One to many
- Many to one
- Many to many

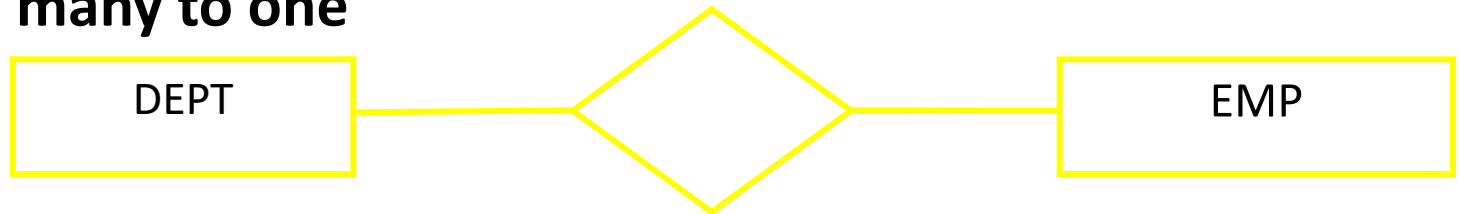


# Types of Cardinalities

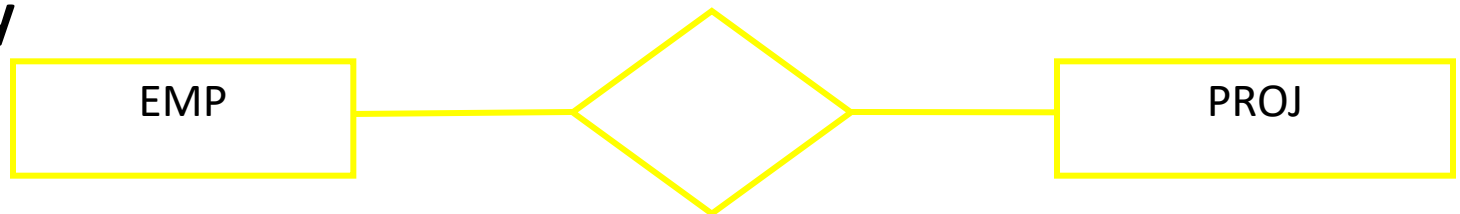
**One to one**



**One to many/ many to one**



**Many to many**



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