Database Management Systems (DBMS)

Lec 9: Entity-Relationship Model (cont.)

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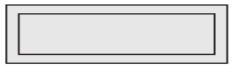
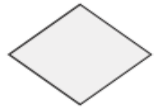
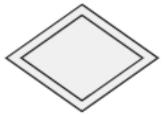
Recap

- ER Model
  - Elements: entities, attributes, and relationships
  - Types of attributes
  - A few notations for ER diagram

Today's plan

- ER Model
  - Elements: entities, attributes, and relationships
  - Types of attributes
  - A few notations for ER diagram

ER diagram notations (Recap)

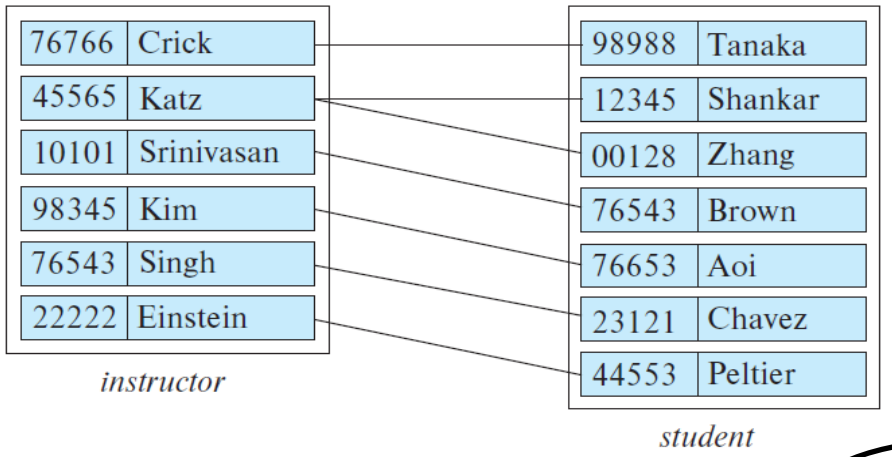
Symbol	Meaning
	Entity
	Weak Entity
	Relationship
	Indentifying Relationship
	Attribute
	Key Attribute
	Multivalued Attribute
	Composite Attribute
	Derived Attribute

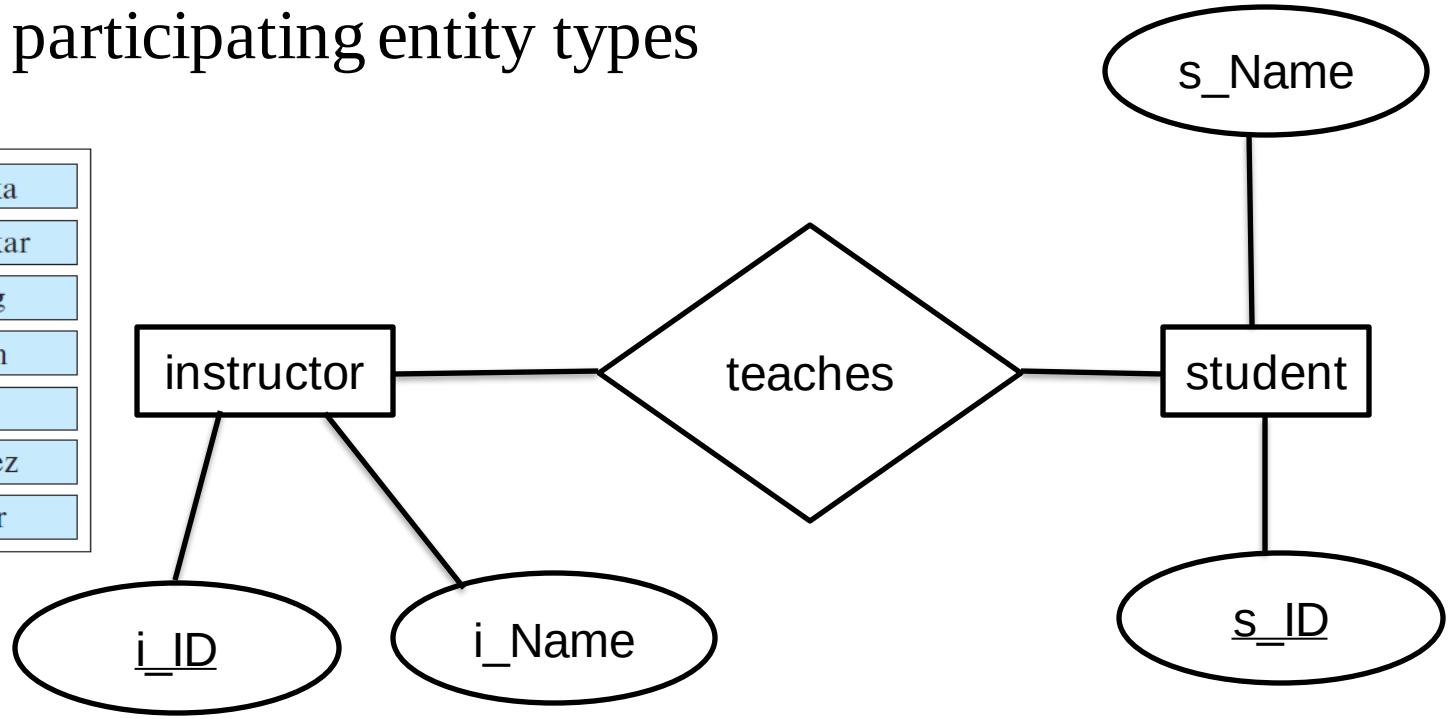
Relationship sets (Recap)

1. ***Relationship:*** an association among several entity types

2. ***Relationship set:*** a set of relationships of the same type

3. ***Degree***: The number of participating entity types





Relationship sets

1. ***Relationship:*** an association among several entity types
2. ***Relationship set:*** a set of relationships of the same type
3. ***Degree***: The number of participating entity types
4. ***Relationship instance:*** association of individual entities and each entity is a member of some entity type participating in the relation
5. ***Role name:*** signifies the role of entities and explains what the relationship means

Observations

- Let n entity types $E_1, E_2, \ldots, E_n$, where $n \geq 2$, are participating in a relation
- A relationship instance $r_i = (e_1, e_2, \ldots, e_n)$, where each entity e_i is a member of entity type $\boldsymbol{E_i}$
- The relationship set $\boldsymbol{R}$ is a subset of $E_1 \times E_2 \times \ldots \times E_n$
  - $i.e., R \subseteq \{(e_1, e_2, \ldots, e_n) \mid e_1 \in E_1, e_2 \in E_2, \ldots, e_n \in E_n\}$

Constraints on binary relationships

- Constraints are the limitations imposed on a relationship and are determined from the miniworld
  - e.g., each employee must work for exactly one department, each student can register for at most 5 electives in a year, etc.
- The main two constraints of a binary relationship are **cardinality ratio** and ***participation***
- Cardinality ratio constraints + Participation constraints = Structural constraints

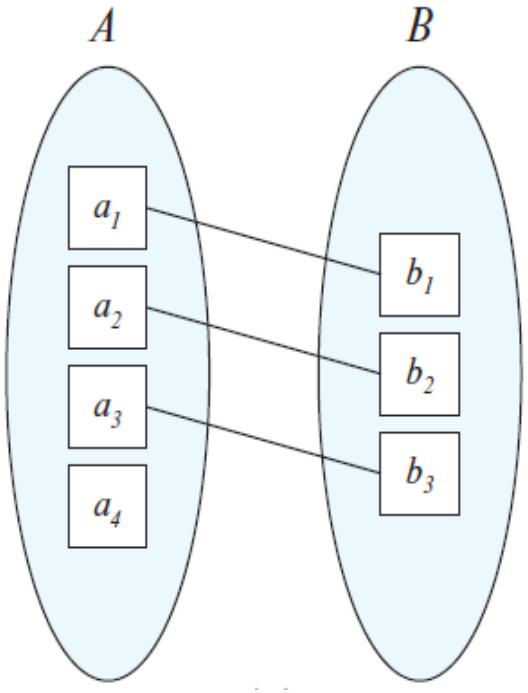
Cardinality constraints

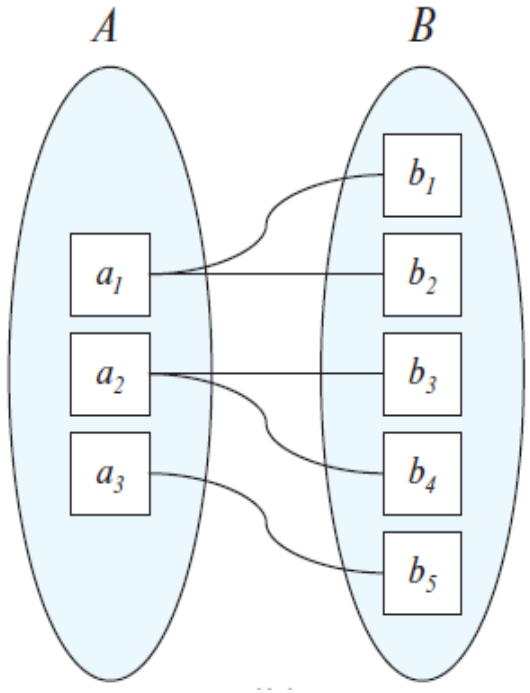
- ***Cardinality ratio:*** the *maximum number* of relationship instances that an entity can participate in

- For two entity types ***A*** and ***B***, the mapping cardinality must be one of the following

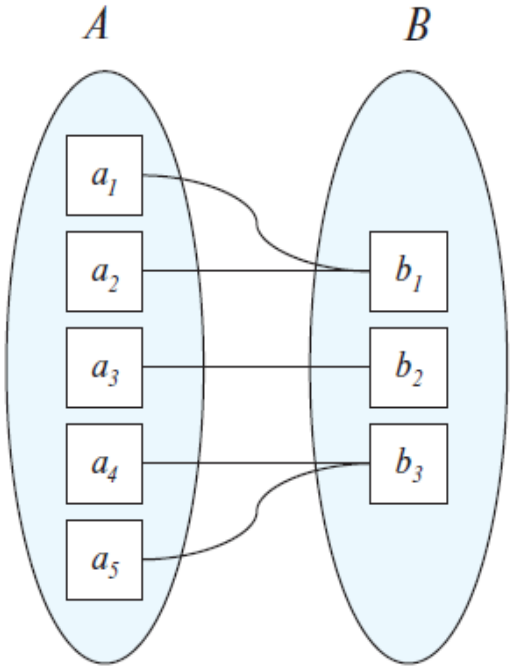
1. *One-to-one* (***1 : 1***)
2. *One-to-many* (***1 : N***)
3. *Many-to-one* (***N : 1***)
4. *Many-to-many* (***M : N***)

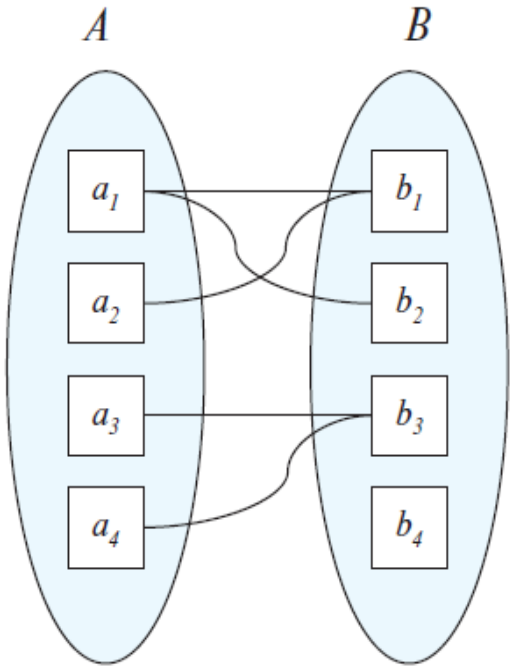
Pictorial representation of 1:1 and 1:N



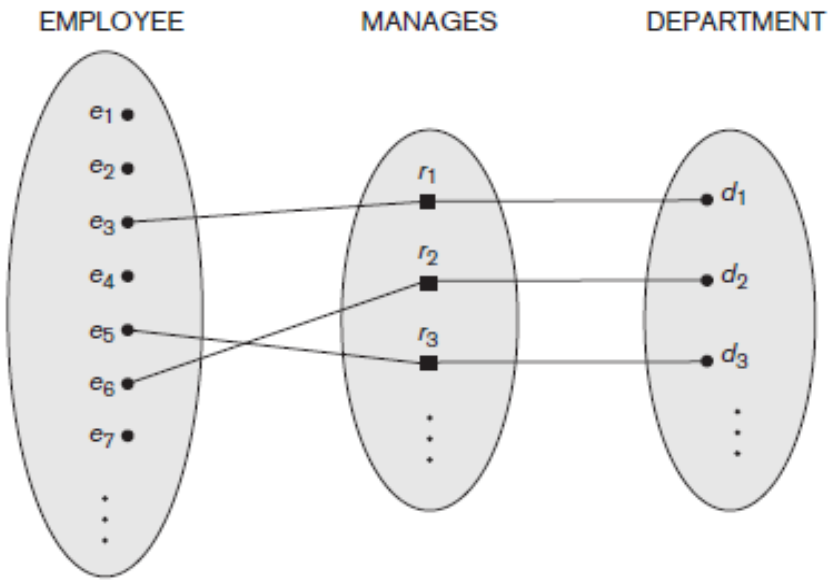


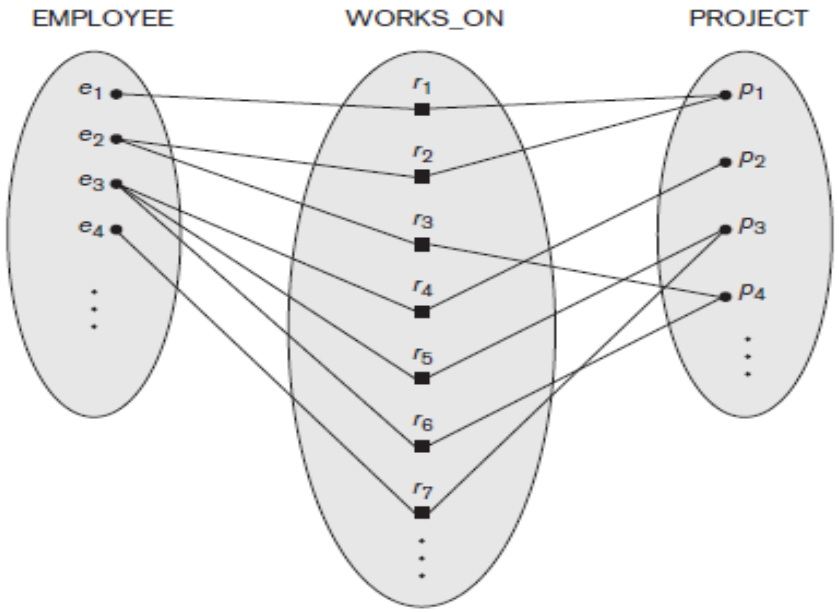
Pictorial representation of N:1 and M:N

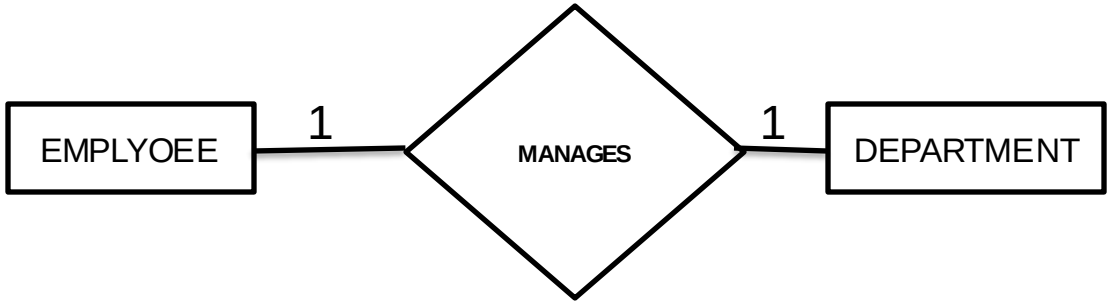


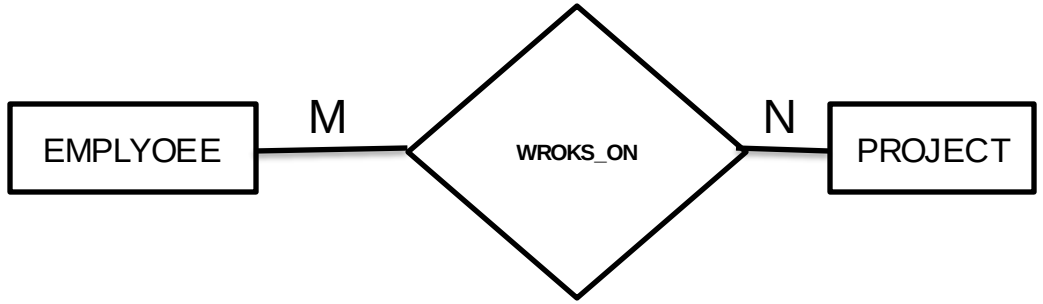


Example


EMPLOYEE
MANAGES
DEPARTMENT
e_1
e_2
e_3
e_4
e_5
e_6
e_7
r_1
r_2
r_3
d_1
d_2
d_3


EMPLOYEE
WORKS_ON
PROJECT
e_1
e_2
e_3
e_4
r_1
r_2
r_3
r_4
r_5
r_6
r_7
p_1
p_2
p_3
p_4

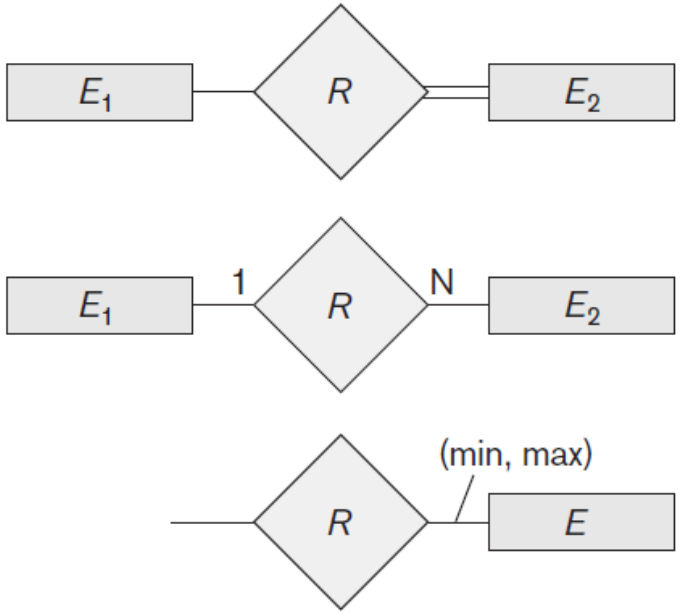

EMPLYOEE
1
MANAGES
1
DEPARTMENT


EMPLYOEE
M
WROKS_ON
N
PROJECT

Participation constraints

- It specifies the *minimum number* of relationship instances that each entity can participate in
  - Total participation constraint
    - e.g., every employee must work for a department
  - Partial participation constraint
    - e.g., an emplyoee manging a department

Other notations for ER diagram



Attributes of relationship

- A relationship may also have attributes called ***descriptive attributes***
  - e.g., the no. of hrs./week an emplyoee works on a particular project
  - Grade of a student between entity types ***Student*** and ***Section***

- Attributes of 1:1 relationship type can be migrated to any of the participating entity types

- Attributes of 1:N relationship type can be migrated to ***only*** to the entity type on the N-side

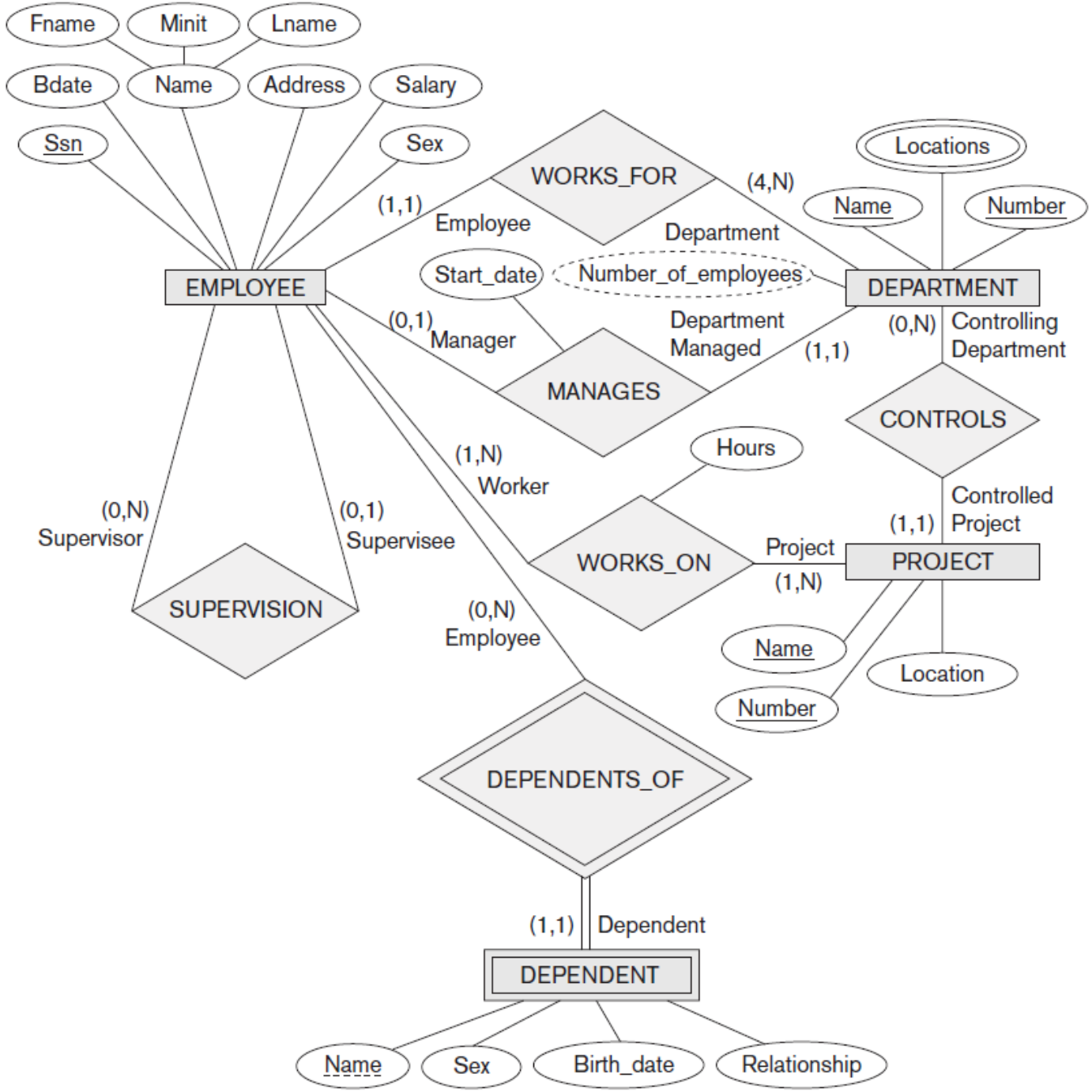
- Attributes of M:N must be specified as a relationship attributes, if they are determined by the combination of participating entity types

Identifying relationship

- Entities belonging to a weak entity type are indentified by other entites
- We call other entity type the ***indentifying*** or ***owner*** entity type
- ***Identifying relationship***: the relationship that relates to a weak entity type to its owner
- Weak entity type always has a total participation constraint*

Identifying relationship

- Entities belonging to a weak entity type are indentified by other entites
- We call other entity type the ***indentifying*** or ***owner*** entity type
- ***Identifying relationship***: the relationship that relates to a weak entity type to its owner
- Weak entity type always has a total participation constraint*
  - Because a weak entity cannot be indentified without an owner entity


Fname
Minit
Lname
Name
Bdate
Address
Salary
Ssn
Sex
EMPLOYEE
WORKS_FOR
(1,1)
Employee
(4,N)
Department
Locations
Name
Number
DEPARTMENT
Start_date
Number_of_employees
(0,1)
Manager
MANAGES
Department
Managed
(1,1)
(0,N)
Controlling
Department
CONTROLS
Hours
(1,N)
Worker
Controlled
Project
(1,1)
(0,N)
Supervisor
(0,1)
Supervisee
WORKS_ON
Project
(1,N)
PROJECT
SUPERVISION
(0,N)
Employee
Name
Location
Number
DEPENDENTS_OF
(1,1)
Dependent
DEPENDENT
Name
Sex
Birth_date
Relationship

Thank you!