

Database Management Systems (DBMS)

Lec 9: Entity-Relationship Model (cont.)

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Minimum cardinality constraint

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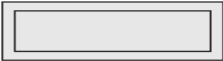
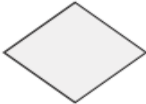






Recap

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

Today's plan

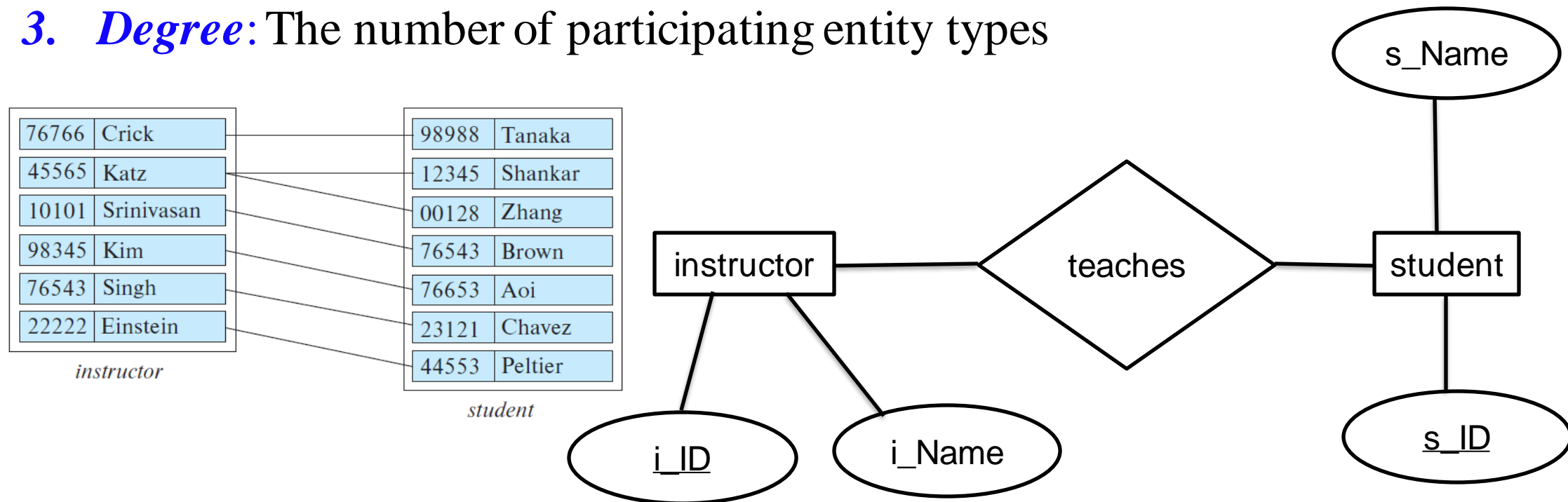
- ER Model
 - Elements: entities, attributes, and relationships
 - Types of attributes
 - A few notations for ER diagram

ER diagram notations (Recap)

Symbol	Meaning
	Entity
	Weak Entity
	Relationship
	Identifying 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, \dots, E_n , where $n \geq 2$, are participating in a relation
- A relationship instance $r_i = (e_1, e_2, \dots, e_n)$, where each entity e_i is a member of entity type E_i
- The relationship set R is a subset of $E_1 \times E_2 \times \dots \times E_n$
 - *i.e.*, $R \subseteq \{(e_1, e_2, \dots, e_n) \mid e_1 \in E_1, e_2 \in E_2, \dots, e_n \in E_n\}$

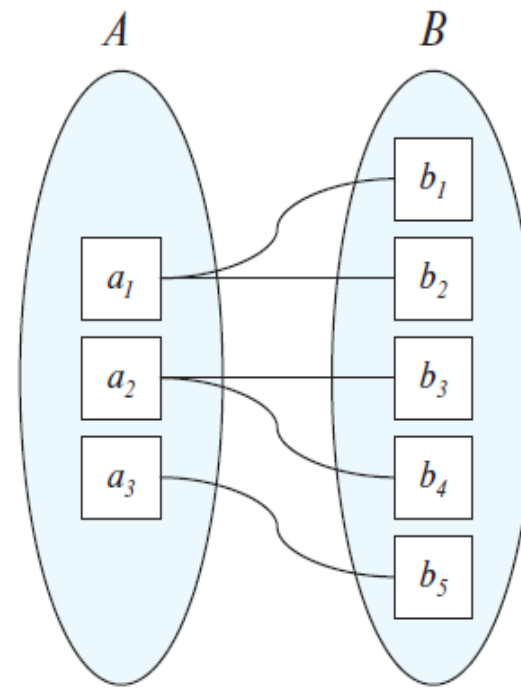
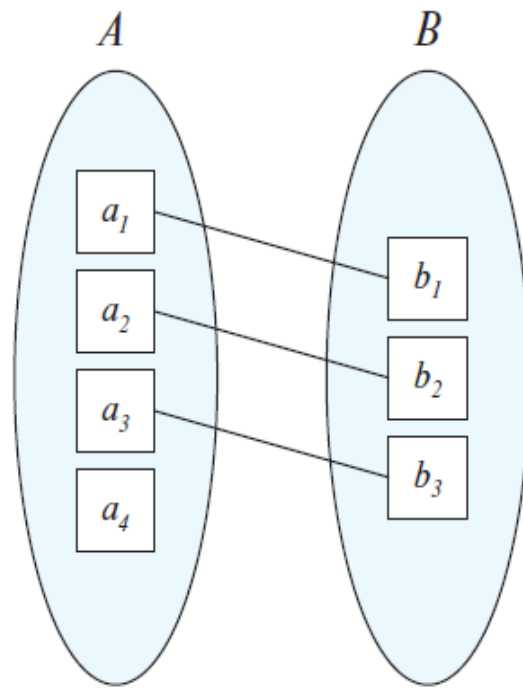
Constraints on binary relationships

- 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

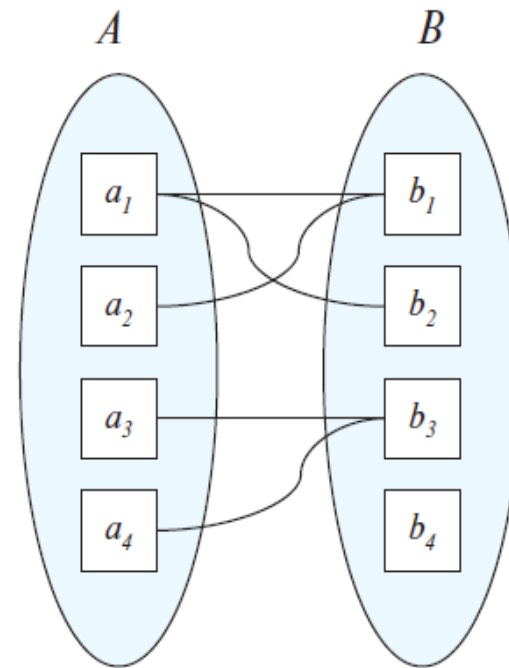
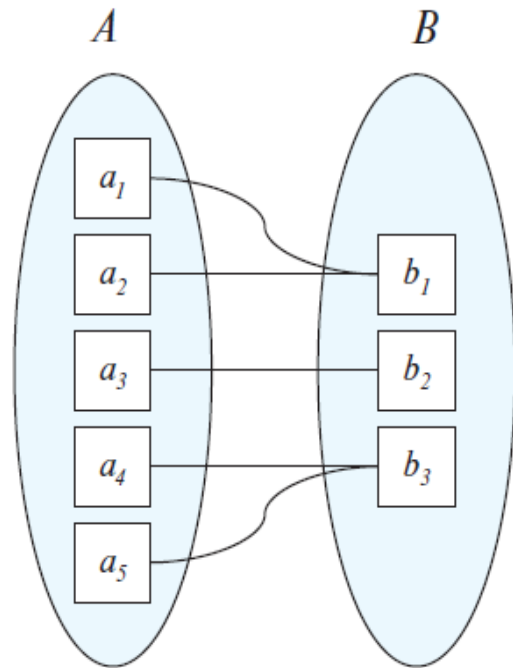
Cardinality constraints

- **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**)

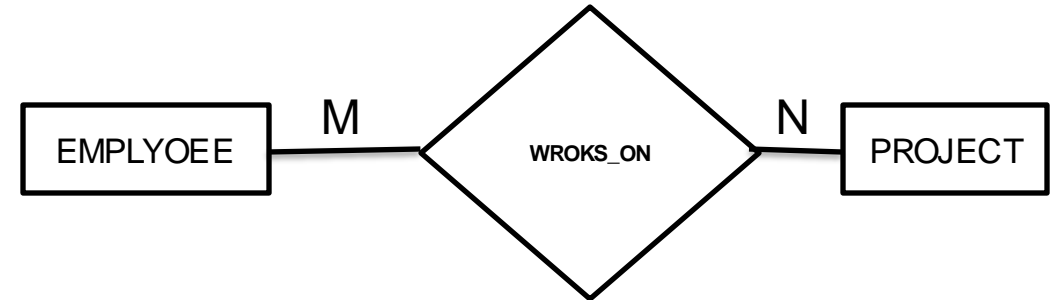
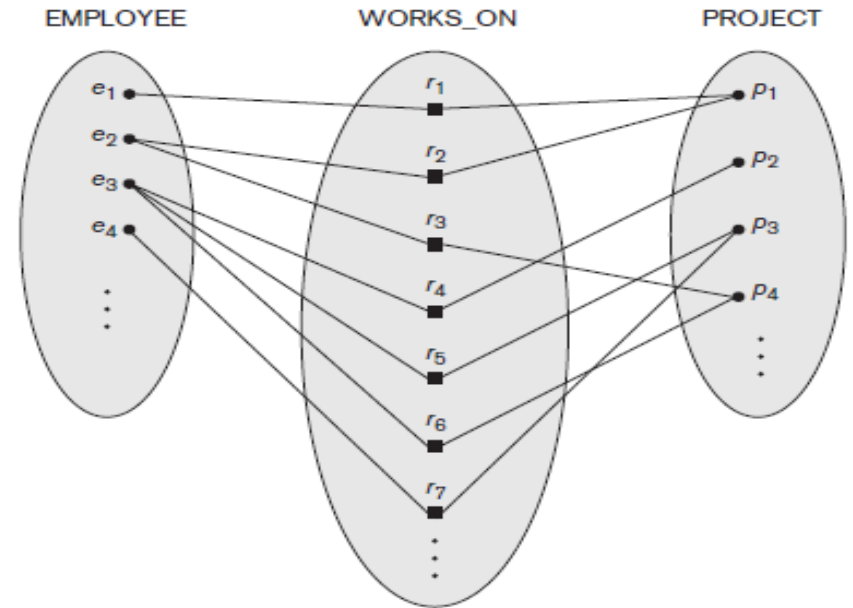
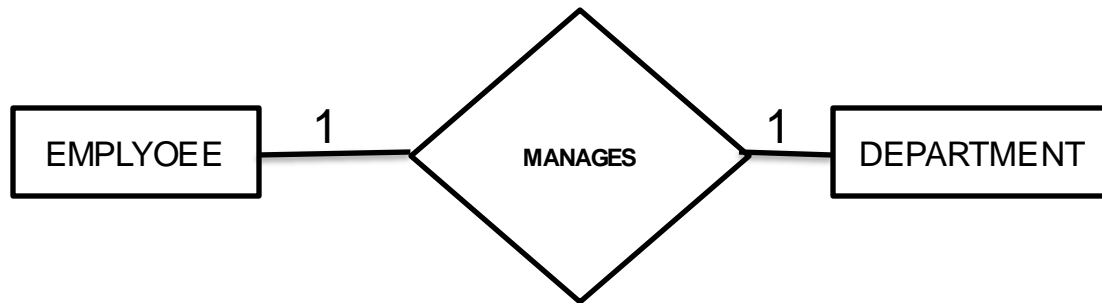
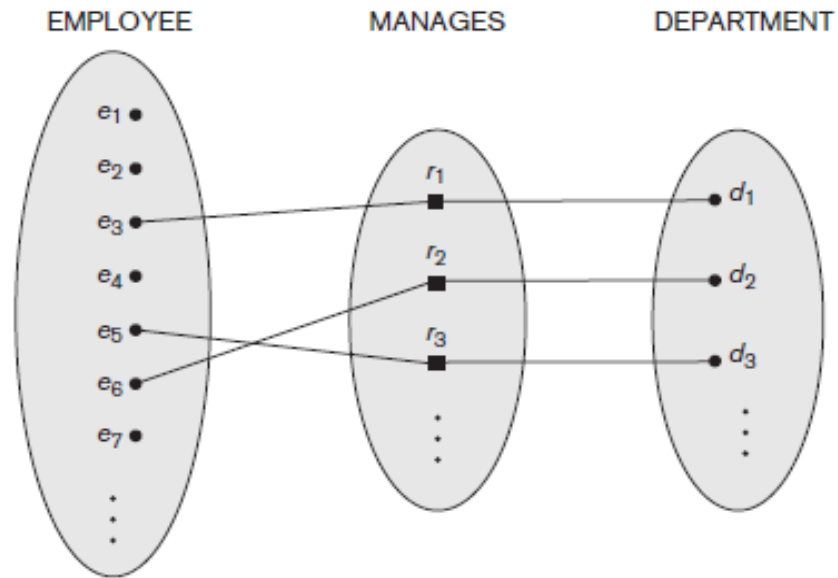
Pictorial representation of 1:1 and 1:N



Pictorial representation of N:1 and M:N



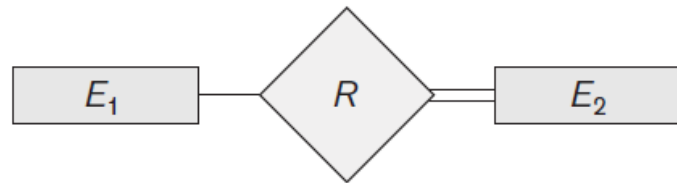
Example



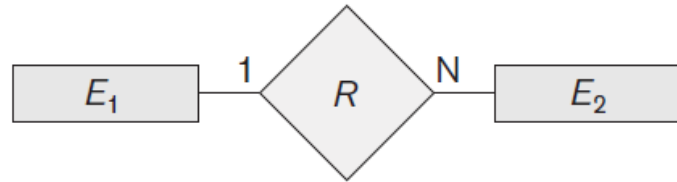
Participation constraints

- 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 employee managing a department

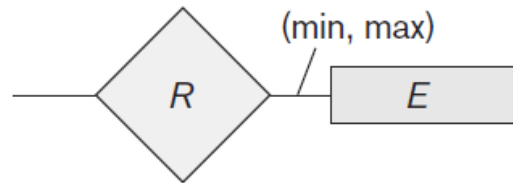
Other notations for ER diagram



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

Attributes of relationship

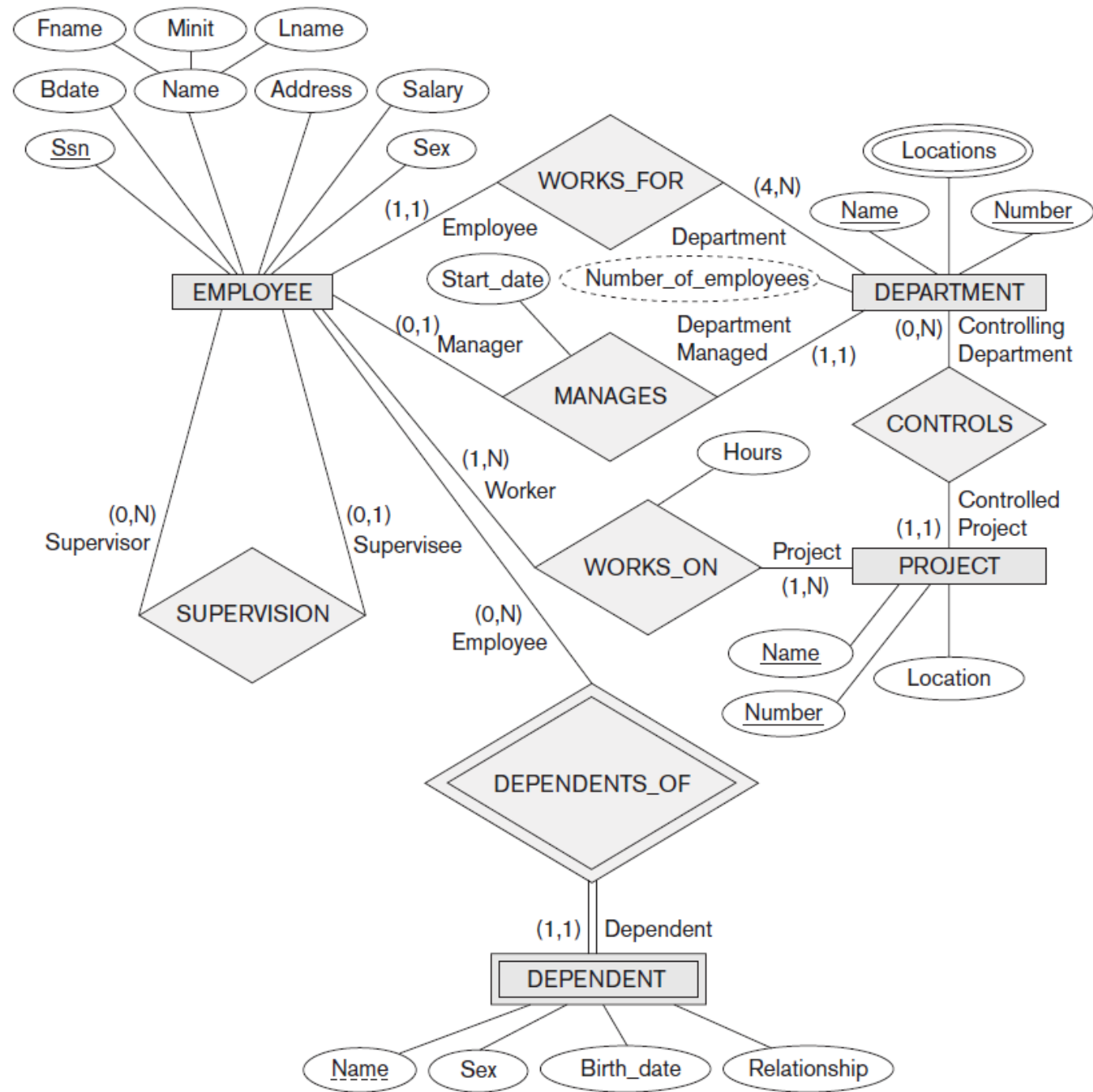
- A relationship may also have attributes called *descriptive attributes*
 - e.g., the no. of hrs./week an employee works on a particular project
 - Grade of a student between entity types *Student* and *Section*
- Attributes of 1:1 relationship type can be migrated to any of the participating entity 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 identified by other entities
- We call other entity type the *identifying* 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*

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- *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 identified without an owner entity



Thank you!