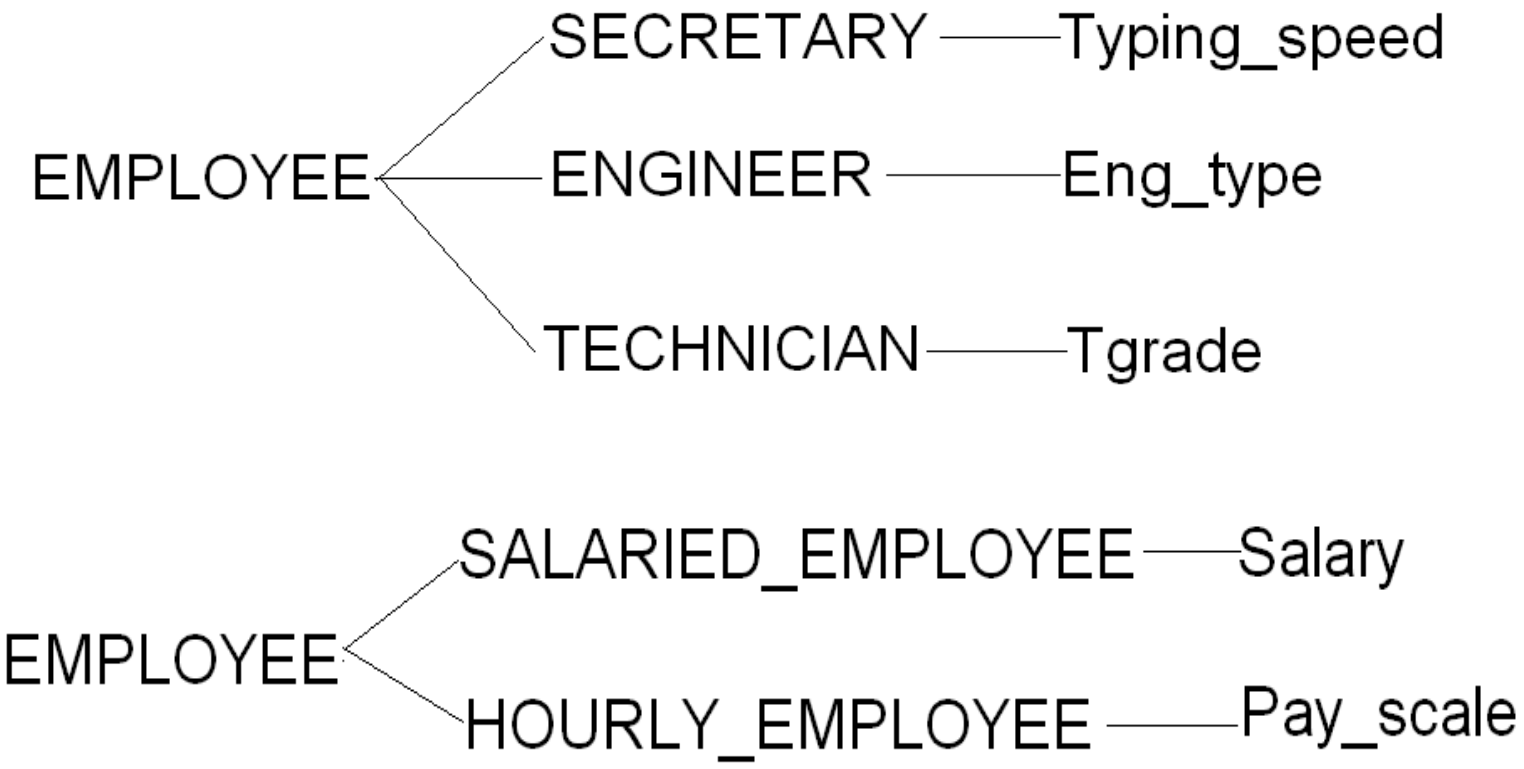
CMSC 127

Enhanced Entity-Relationship (EER) Modeling

Reginald Neil C. Recario
Institute of Computer Science
University of the Philippines Los Baños

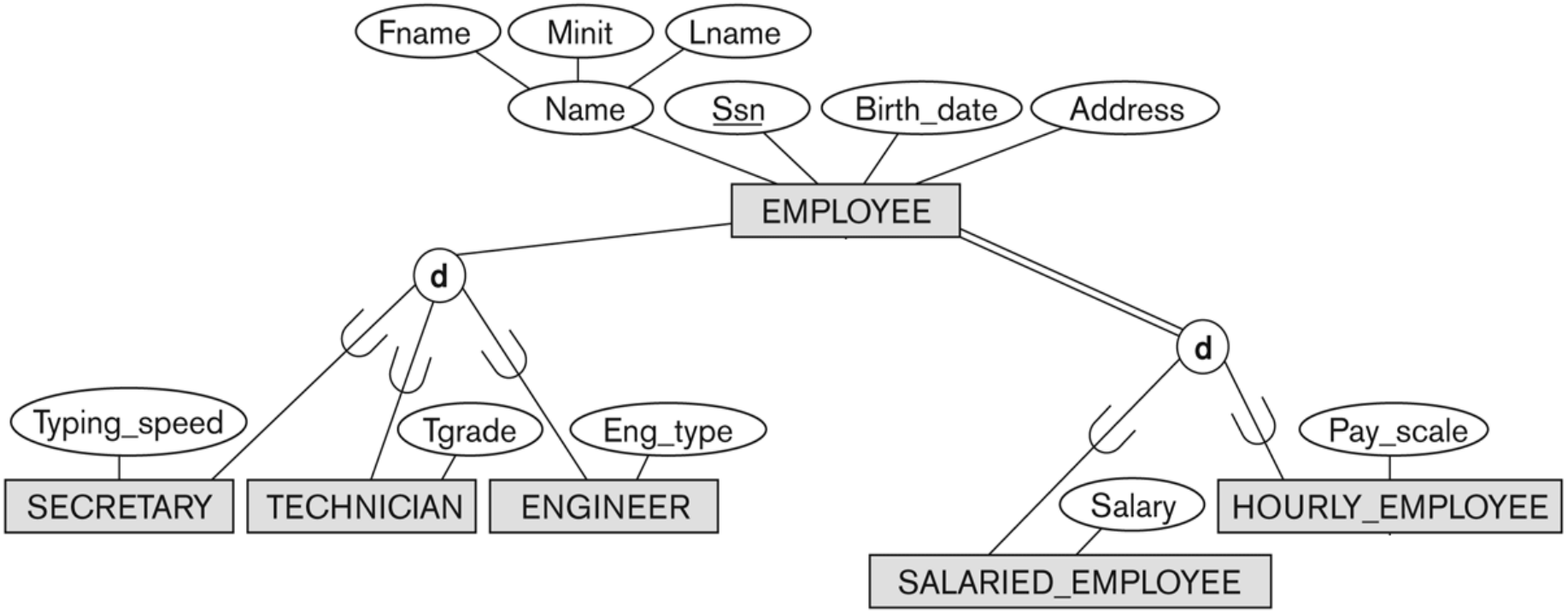
Subclasses and Superclasses



Subclasses and Superclasses

- Each subgroup
  - is a subset of EMPLOYEE entities
  - is called a subclass of EMPLOYEE
  - under a superclass named EMPLOYEE
- Superclass/subclass relationships:
  - EMPLOYEE/SECRETARY
  - EMPLOYEE/TECHNICIAN
  - EMPLOYEE/SALARIED
  - Also called as IS-A relationships

Subclasses and Superclasses in EER



Subclasses and Superclasses

- An entity that is member of a subclass represents the same real-world entity as some member of the superclass:
  - The subclass member is the same entity in a ***distinct specific role***.
  - An entity cannot exist in the database merely by being a member of a subclass.
  - A member of the superclass can be optionally included as a member of any number of its subclasses.

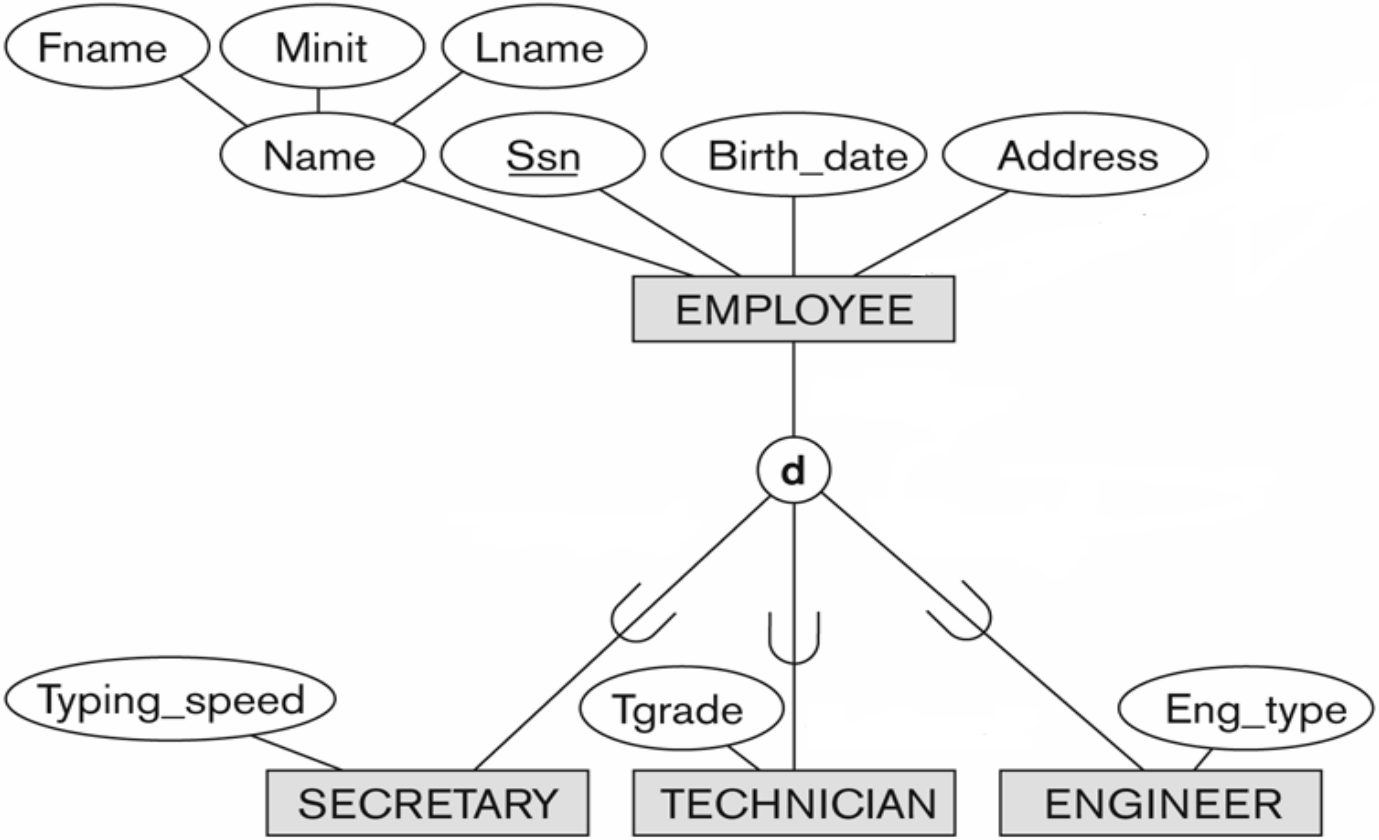
Inheritance

- An entity that is a member of a subclass *inherits*:
  - All attributes of the entity as a member of the superclass
  - All relationships of the entity as a member of the superclass

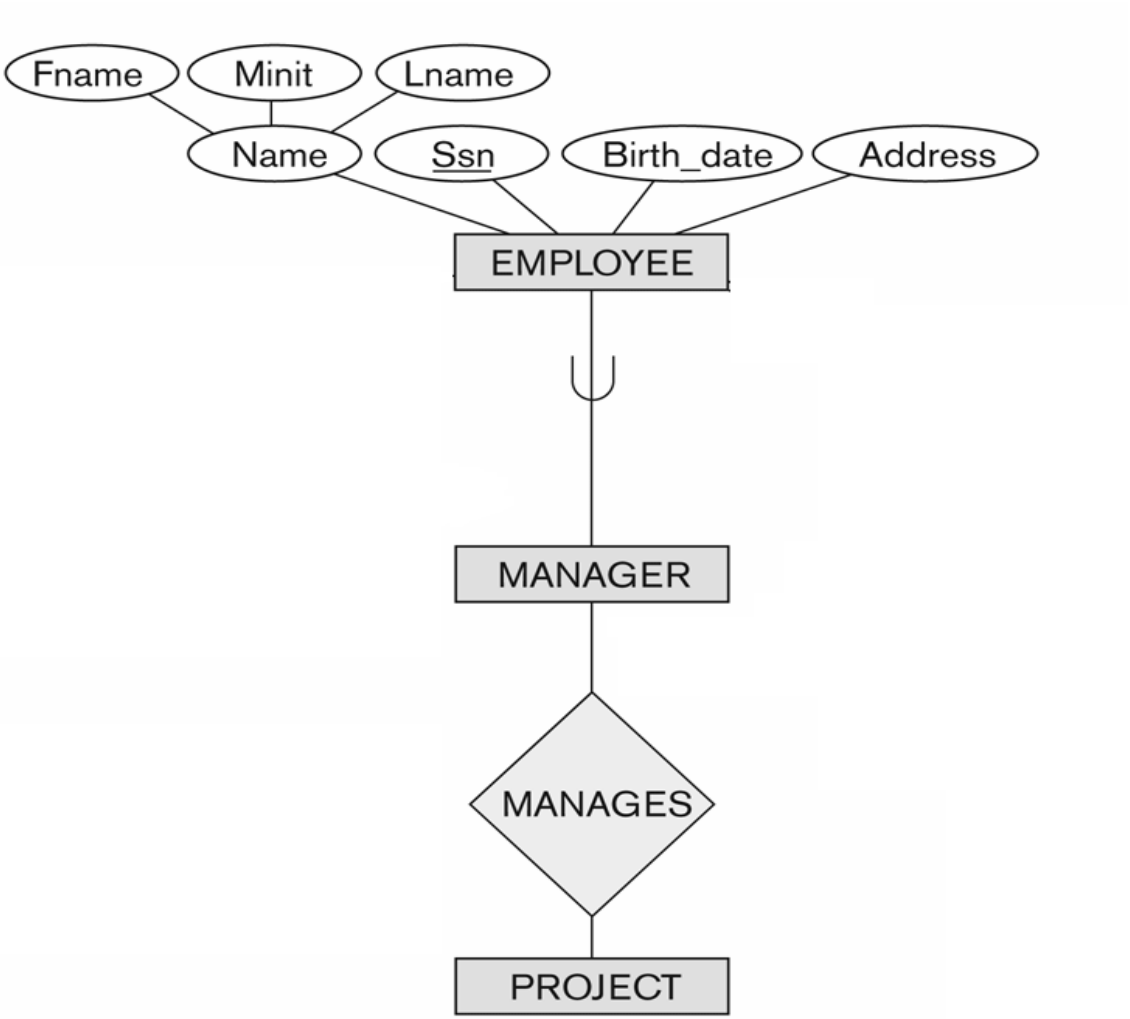
Specialization

- is the process of defining a set of subclasses of a superclass
- a top-down design process
- is appropriate if:
  - A subclass has specific attributes
  - A subclass participates in a specific relationship type

Defining a subclass



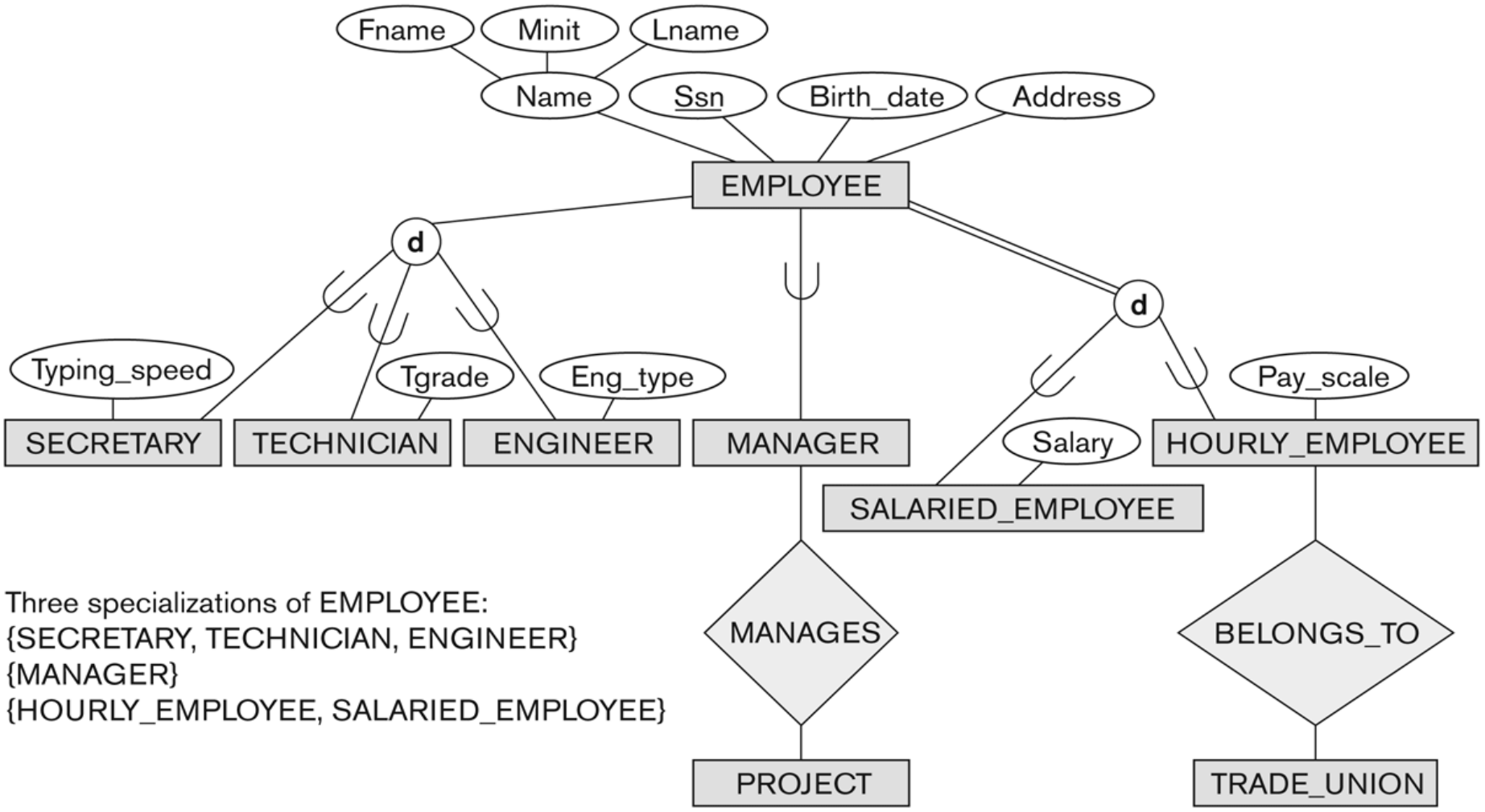
Defining a subclass



Specialization

- Attributes of a subclass are called ***specific*** or ***local*** attributes.
- Several specializations can be made out of the same superclass.

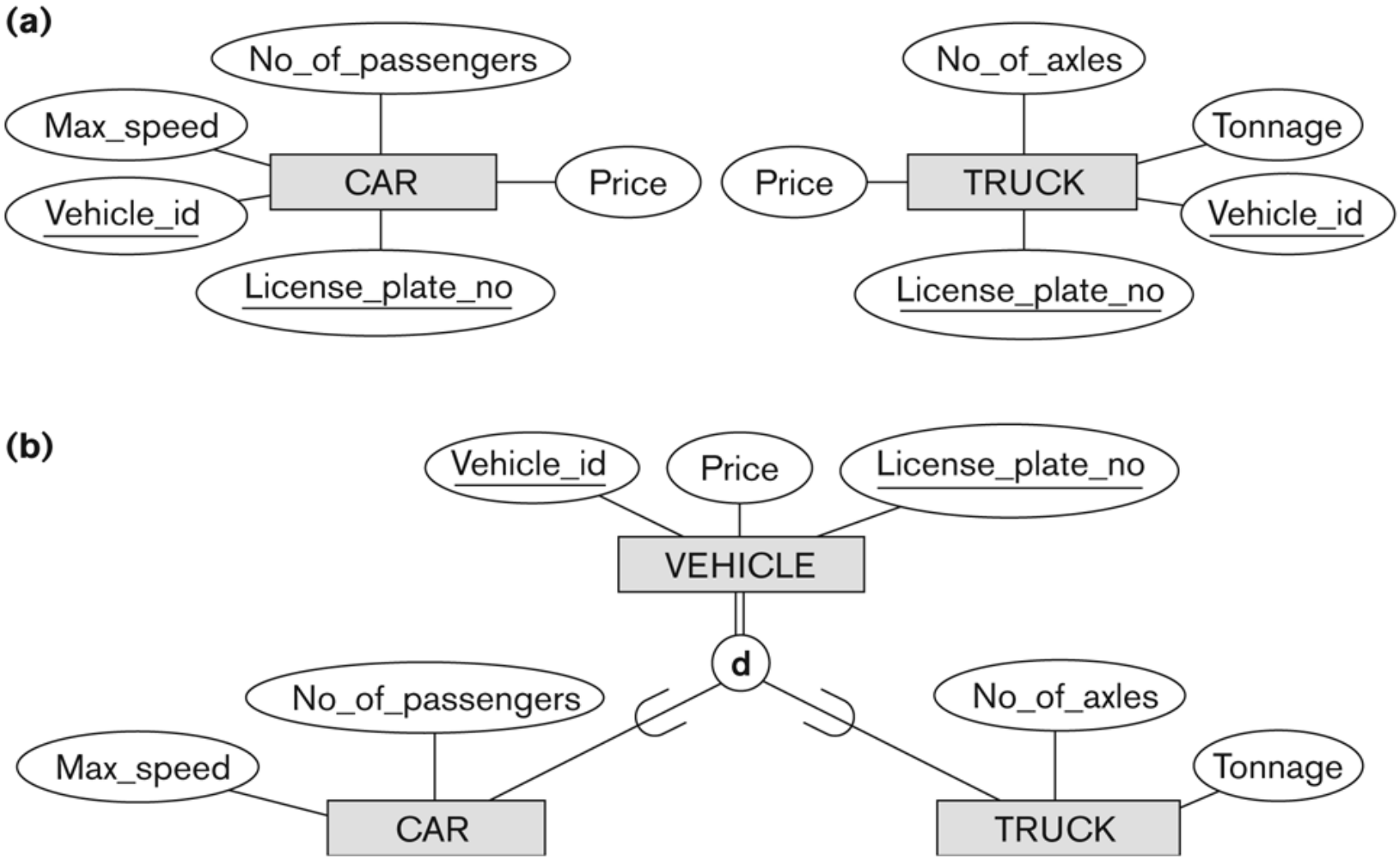
Specialization



Three specializations of EMPLOYEE:
{SECRETARY, TECHNICIAN, ENGINEER}
{MANAGER}
{HOURLY_EMPLOYEE, SALARIED_EMPLOYEE}

Generalization

- Several classes with common features are generalized into a ***superclass***.
- ***Generalization*** is the reverse of the specialization process.
- A bottom-up design process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CAR
Price
Vehicle_id
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No_of_axles
Tonnage
Price
TRUCK
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License_plate_no
(b)
Vehicle_id
Price
License_plate_no
VEHICLE
d
No_of_passengers
Max_speed
CAR
No_of_axles
Tonnage
TRUCK

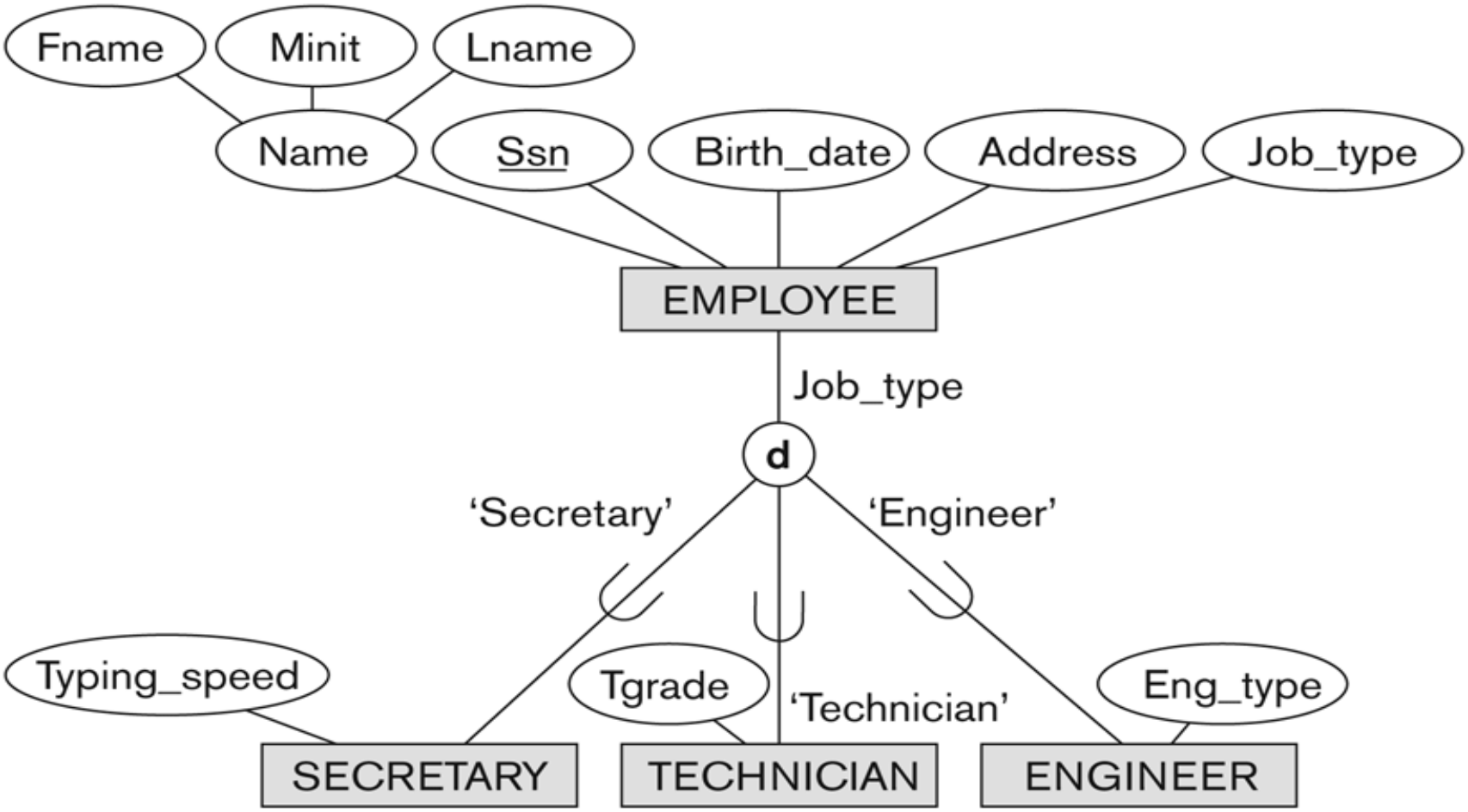
Constraints on Specialization and Generalization

- Constraints on which entities can be members of a a subclass
- Condition-defined or Predicate-defined
  - members of each subclass are determined by a condition
  - Display a predicate-defined subclass by writing the predicate condition next to the line attaching the subclass to its superclass.

Constraints on Specialization and Generalization

- Attribute-defined
  - If all subclasses in a specialization have membership condition on same attribute of the superclass
  - Attribute is called the ***defining attribute*** of the specialization
  - Example: JobType is the defining attribute of the specialization {SECRETARY, TECHNICIAN, ENGINEER} of EMPLOYEE

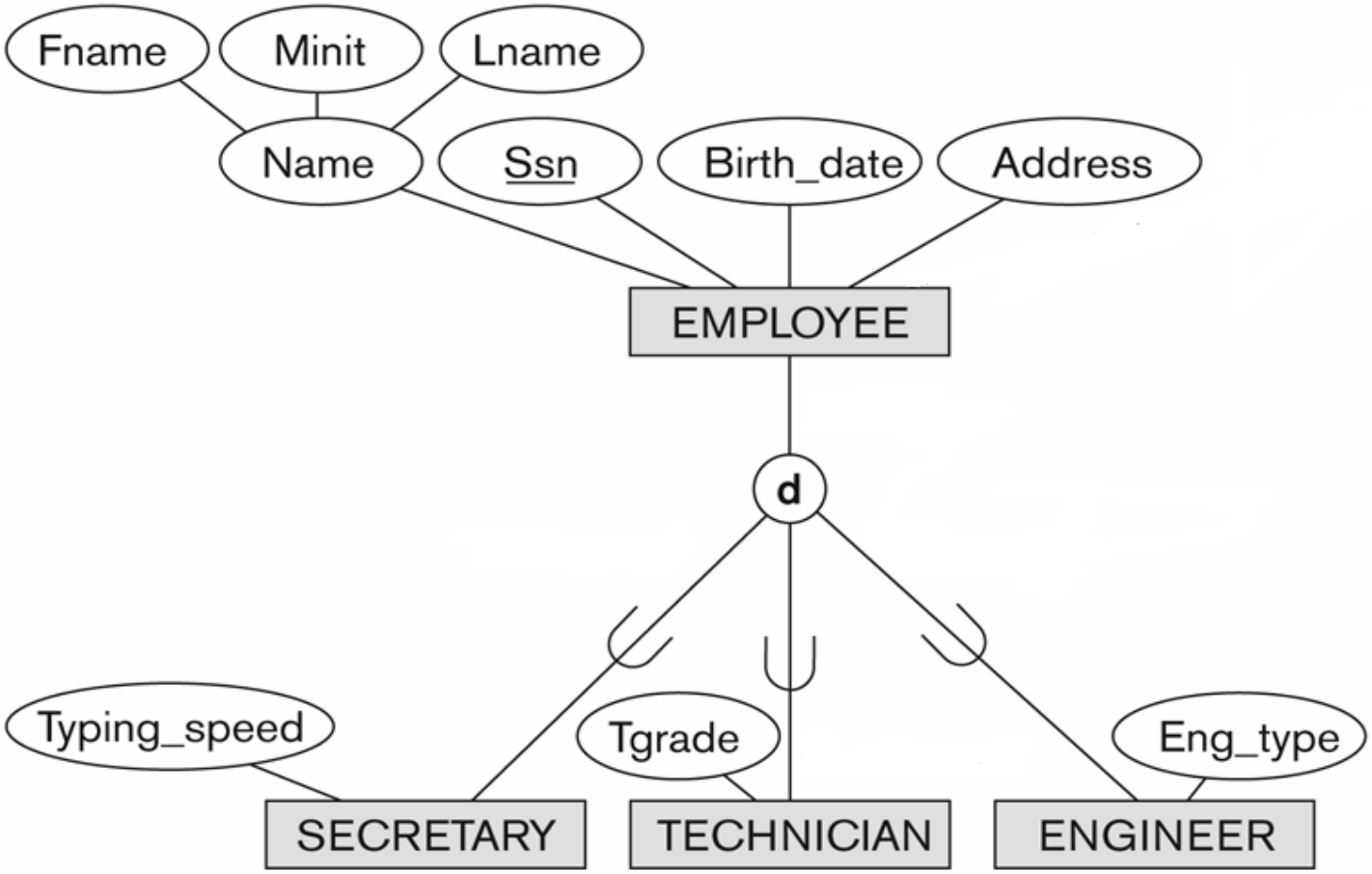
Displaying an attribute-defined specialization in EER diagrams



Constraints on Specialization and Generalization

- ***User-defined***
  - If no condition determines membership
  - Membership in a subclass is determined by the database users by applying an operation to add an entity to the subclass

Displaying a user-defined specialization in EER diagrams



Constraints on Specialization and Generalization

- Constraint on whether or not entities may belong to more than one subclass within a single generalization/specialization
- ***Disjointness Constraint***:
  - Disjoint
  - Overlapping

Constraints on Specialization and Generalization

- ***Disjoint:***
  - an entity can be a member of at most one of the subclasses of the specialization
  - Specified by ***d*** in EER diagram
- ***Overlapping:***
  - the same entity may be a member of more than one subclass of the specialization
  - Specified by **o** in EER diagram

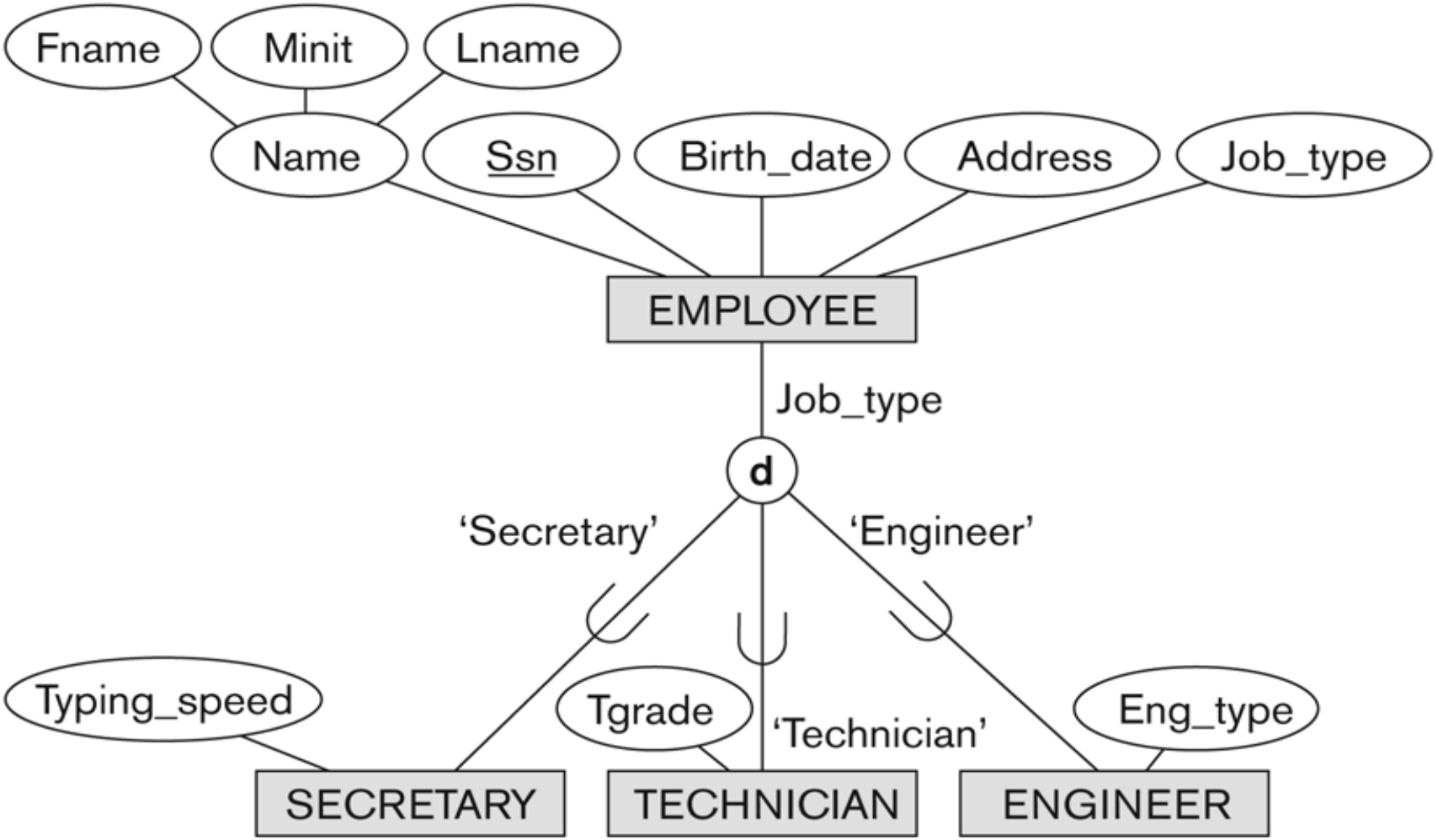
Constraints on Specialization and Generalization

- Constraint on whether or not entity in superclass must belong to at least one of the subclasses within a single specialization/generalization
- ***Completeness Constraint*:**
  - Total
  - Partial

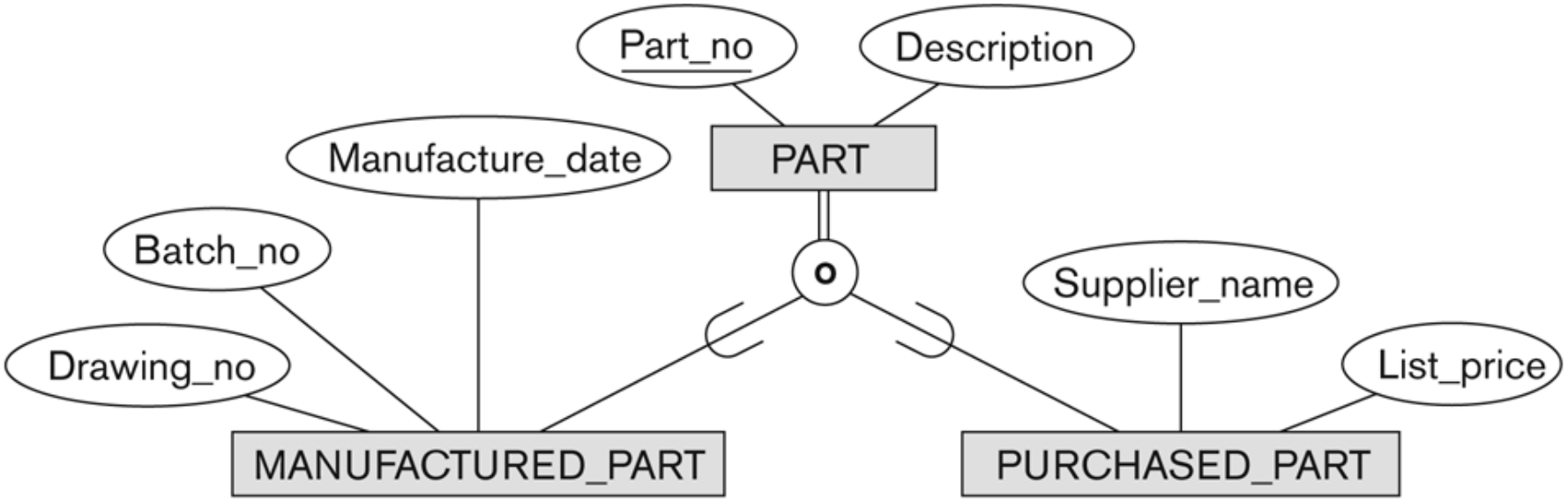
Constraints on Specialization and Generalization

- ***Total***:
  - every entity in the superclass must be a member of some subclass in the specialization/generalization
  - Shown in EER diagrams by a ***double line***
- ***Partial***
  - allows an entity not to belong to any of the subclasses
  - Shown in EER diagrams by a ***single line***
- Note: Generalization usually is total because the superclass is derived from the subclasses.

Example of a disjoint partial Specialization



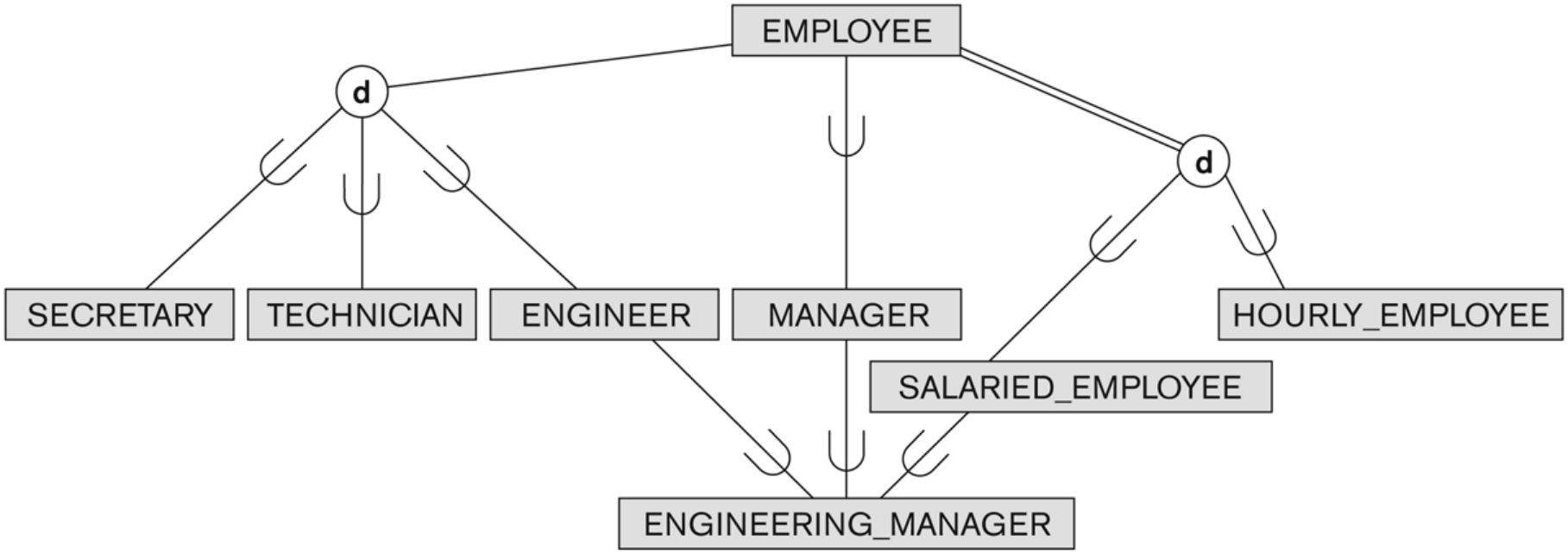
Example of an overlapping total Specialization



Hierarchy and Lattice

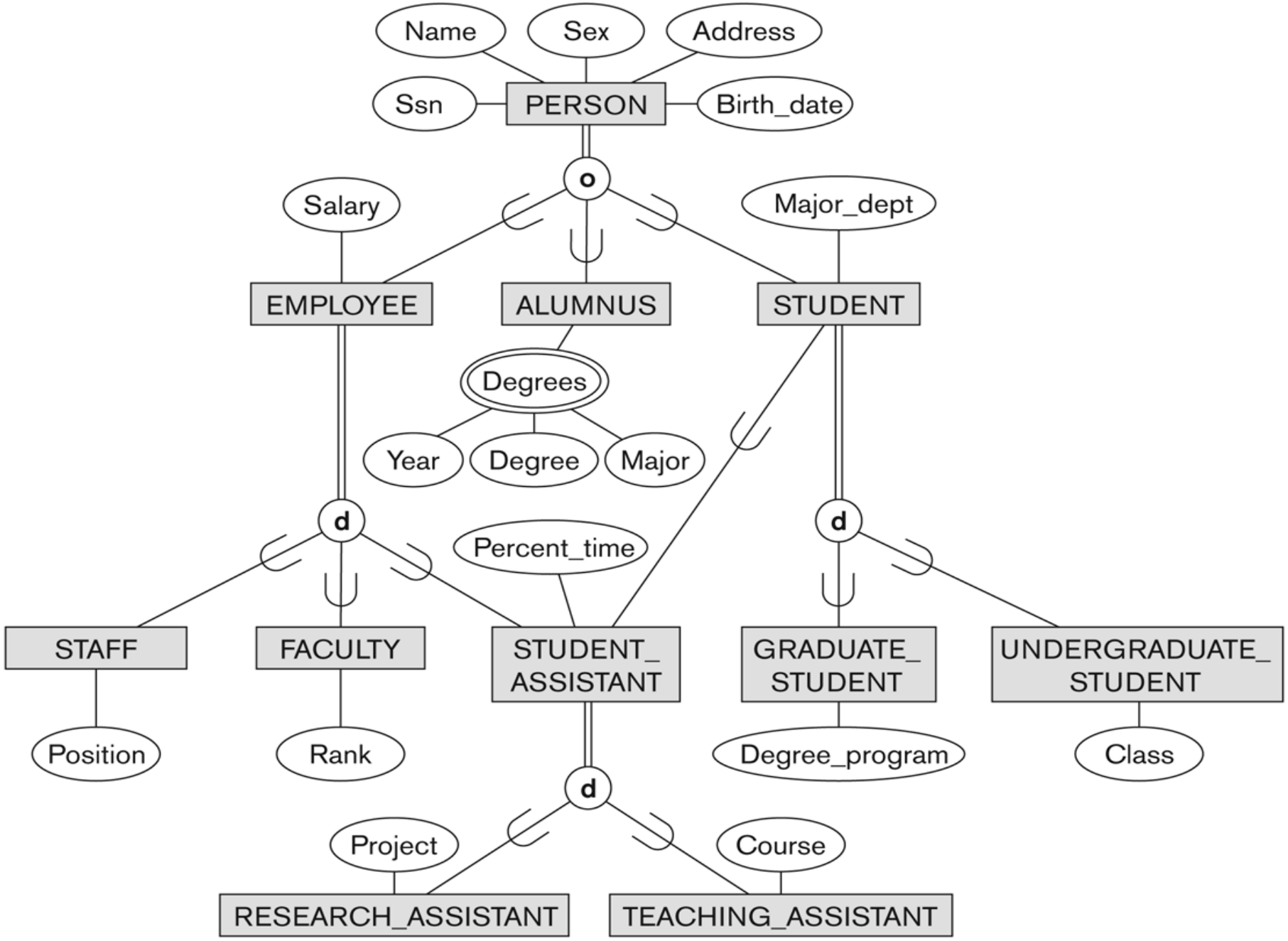
- A subclass may itself have further subclasses specified on it
  - forms a hierarchy or a lattice
- Hierarchy :
  - every subclass has only one superclass (called ***single inheritance***); this is basically a ***tree structure***
- Lattice:
  - a subclass can be subclass of more than one superclass (called ***multiple inheritance***)

Example of a lattice



Lattices & Shared Subclasses

- In a lattice or hierarchy, a subclass inherits attributes not only of its direct superclass, but also of all its predecessor superclasses
- A subclass with more than one superclass is called a shared subclass (multiple inheritance)
- Can have:
  - ***specialization*** hierarchies or lattices, or
  - ***generalization*** hierarchies or lattices


Name
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Ssn
PERSON
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Salary
Major_dept
EMPLOYEE
ALUMNUS
STUDENT
Degrees
Year
Degree
Major
d
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d
STAFF
FACULTY
STUDENT_
ASSISTANT
GRADUATE_
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STUDENT
Position
Rank
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d
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RESEARCH_ASSISTANT
TEACHING_ASSISTANT