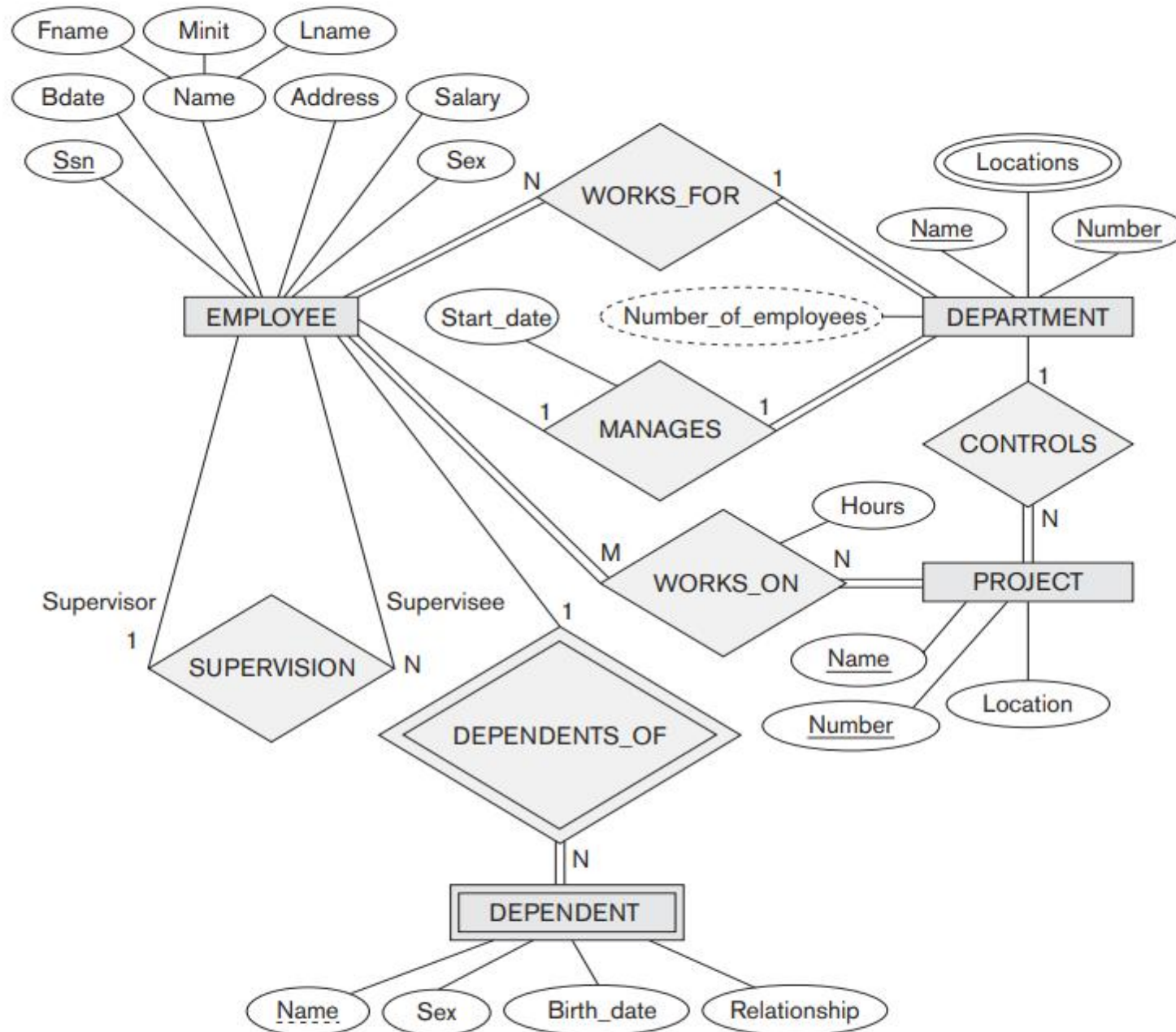


Figure 9.1

The ER conceptual schema diagram for the COMPANY database.



EMPLOYEE

Fname	Minit	Lname	<u>Ssn</u>	Bdate	Address	Sex	Salary	Super_ssn	Dno
-------	-------	-------	------------	-------	---------	-----	--------	-----------	-----

DEPARTMENT

Dname	<u>Dnumber</u>	Mgr_ssn	Mgr_start_date
-------	----------------	---------	----------------

DEPT_LOCATIONS

<u>Dnumber</u>	<u>Dlocation</u>
----------------	------------------

PROJECT

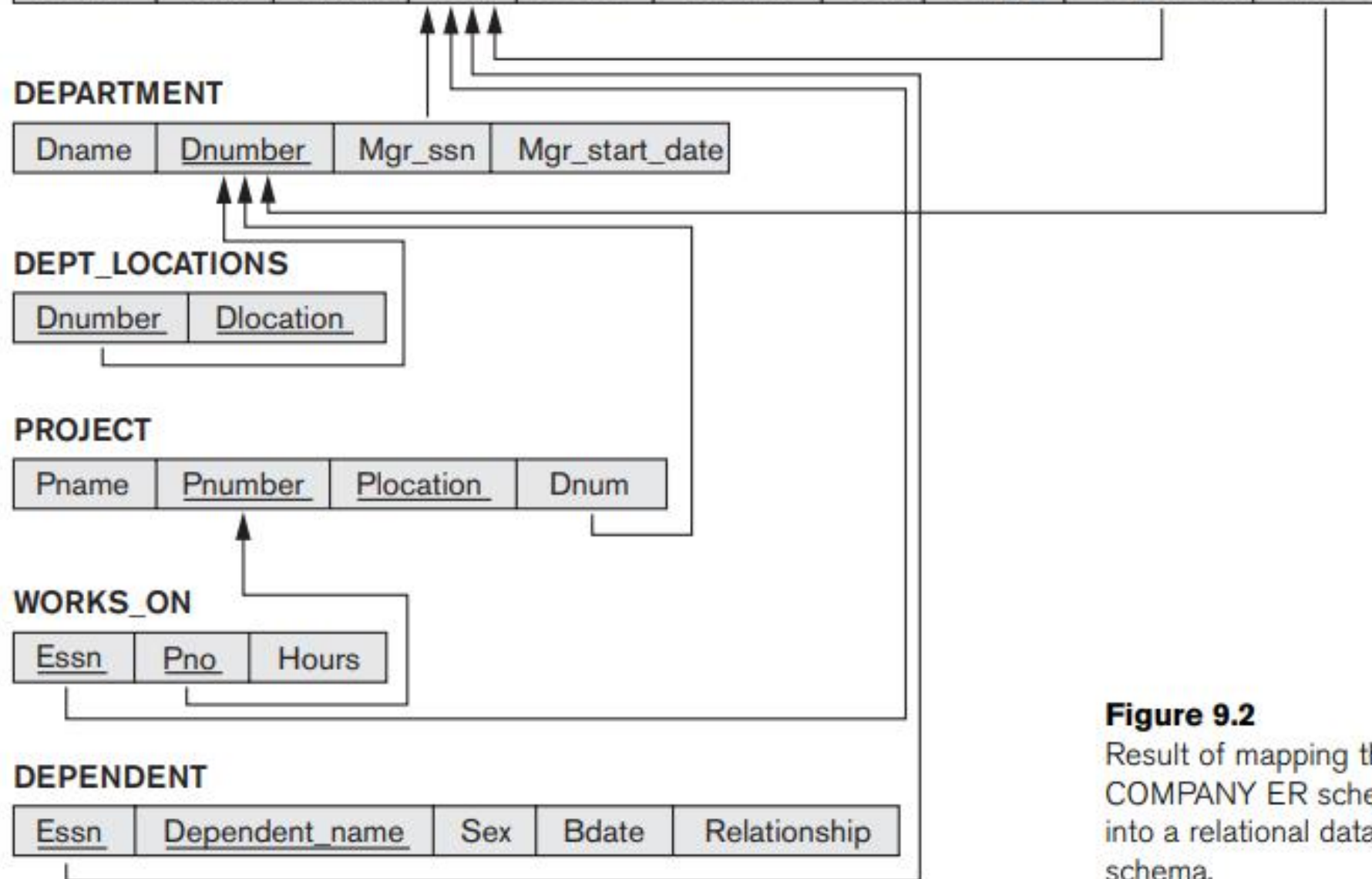
Pname	<u>Pnumber</u>	<u>Plocation</u>	Dnum
-------	----------------	------------------	------

WORKS_ON

<u>Essn</u>	<u>Pno</u>	Hours
-------------	------------	-------

DEPENDENT

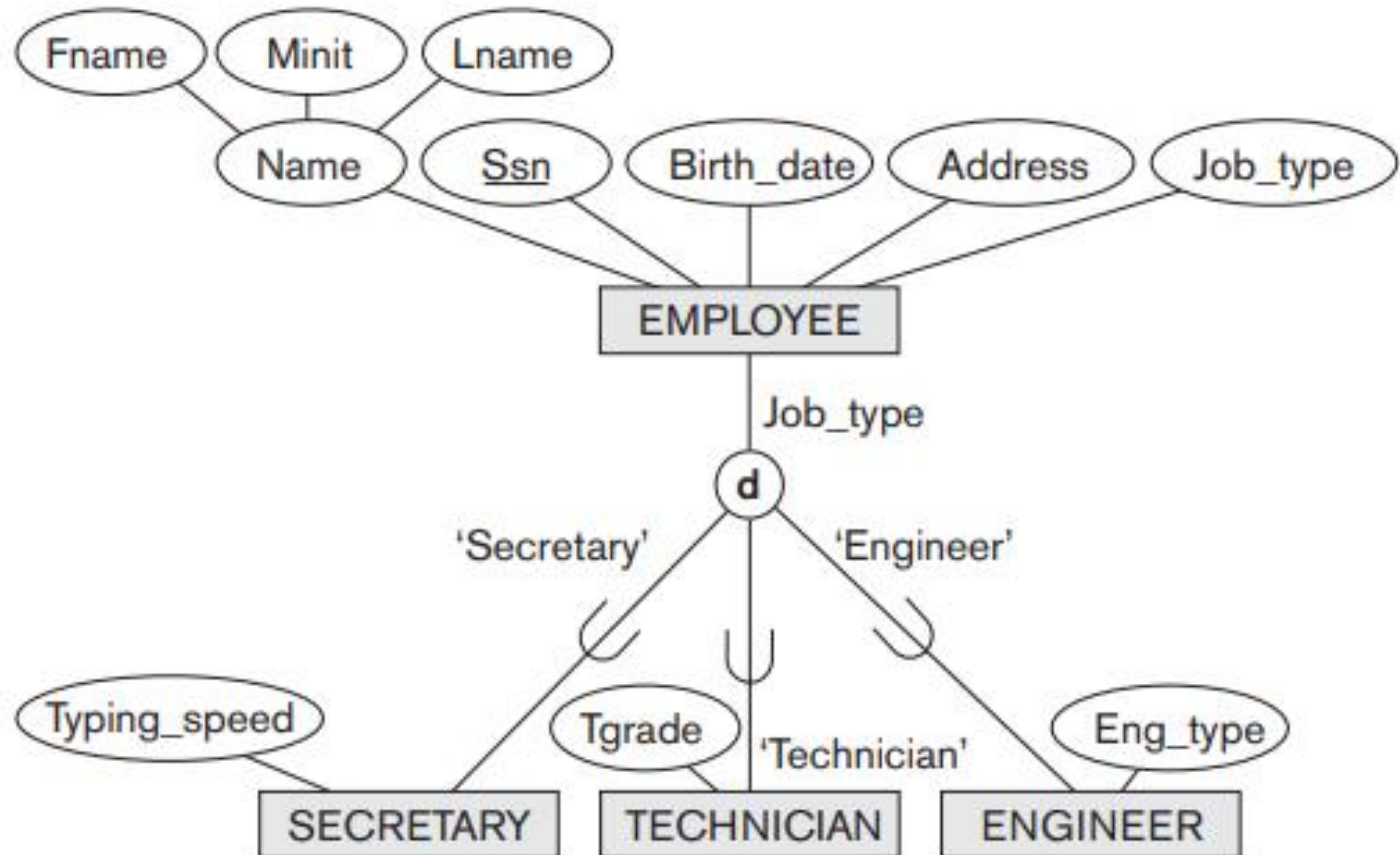
<u>Essn</u>	<u>Dependent_name</u>	Sex	Bdate	Relationship
-------------	-----------------------	-----	-------	--------------

**Figure 9.2**

Result of mapping the COMPANY ER schema into a relational database schema.

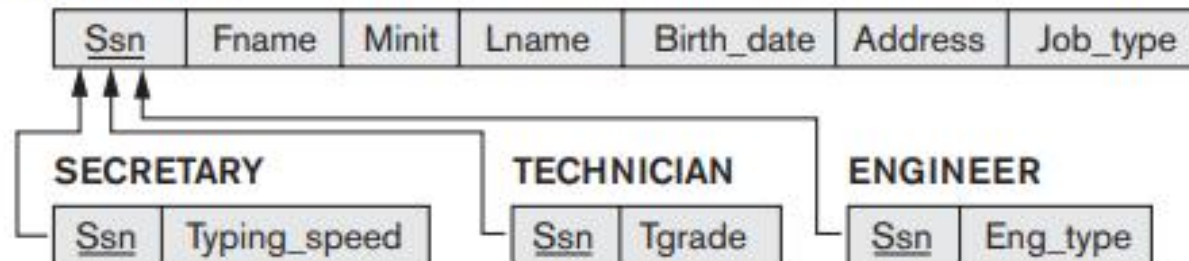
Figure 8.4

EER diagram notation for an attribute-defined specialization on Job_type.



⁶Such an attribute is called a *discriminator* in UML terminology.

(a) EMPLOYEE



(b) CAR

<u>Vehicle_id</u>	License_plate_no	Price	Max_speed	No_of_passengers
-------------------	------------------	-------	-----------	------------------

TRUCK

<u>Vehicle_id</u>	License_plate_no	Price	No_of_axles	Tonnage
-------------------	------------------	-------	-------------	---------

(c) EMPLOYEE

<u>Ssn</u>	Fname	Minit	Lname	Birth_date	Address	Job_type	Typing_speed	Tgrade	Eng_type
------------	-------	-------	-------	------------	---------	----------	--------------	--------	----------

(d) PART

<u>Part_no</u>	Description	Mflag	Drawing_no	Manufacture_date	Batch_no	Pflag	Supplier_name	List_price
----------------	-------------	-------	------------	------------------	----------	-------	---------------	------------

Figure 9.5

Options for mapping specialization or generalization. (a) Mapping the EER schema in Figure 8.4 using option 8A. (b) Mapping the EER schema in Figure 8.3(b) using option 8B. (c) Mapping the EER schema in Figure 8.4 using option 8C. (d) Mapping Figure 8.5 using option 8D with Boolean type fields Mflag and Pflag.

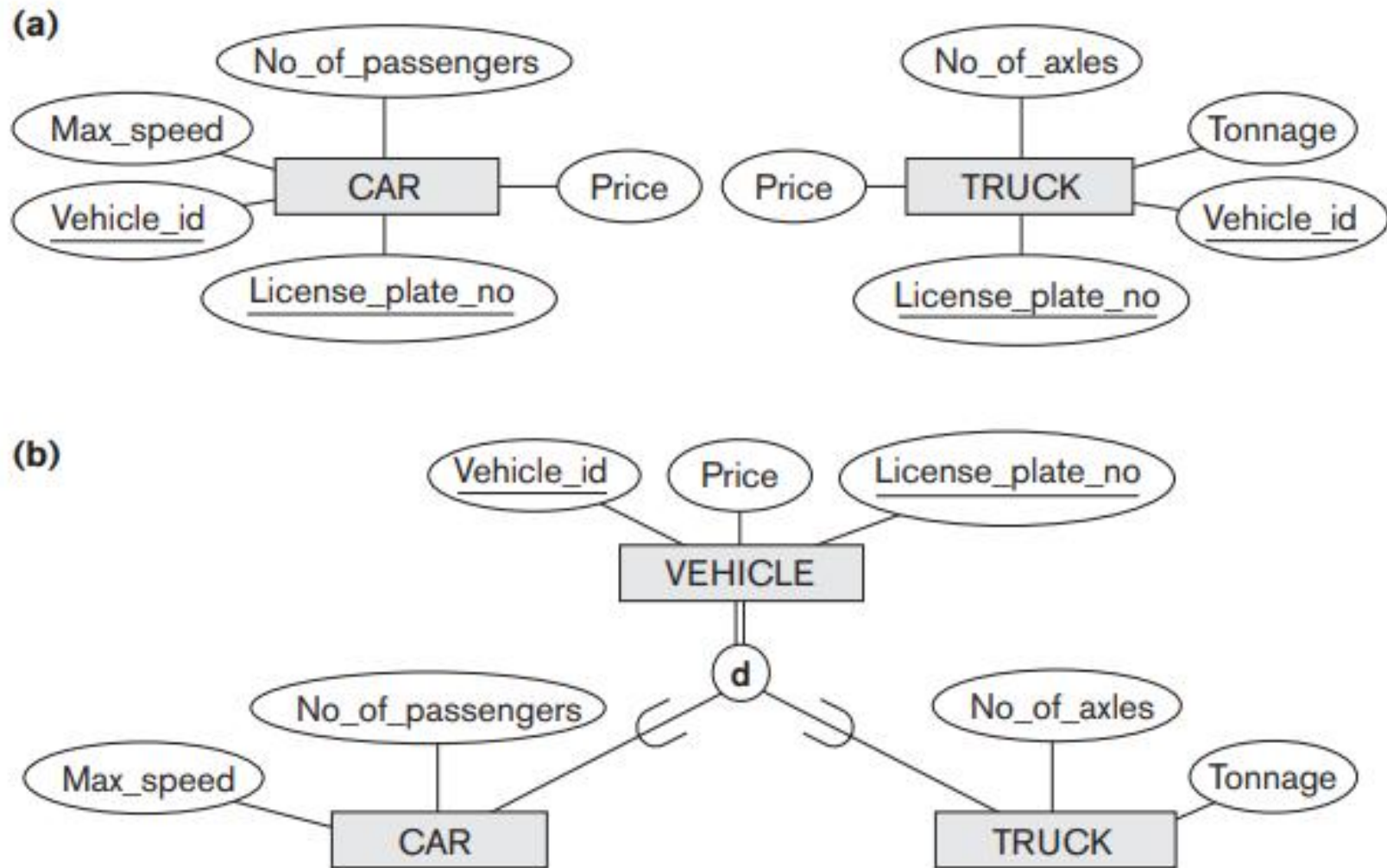
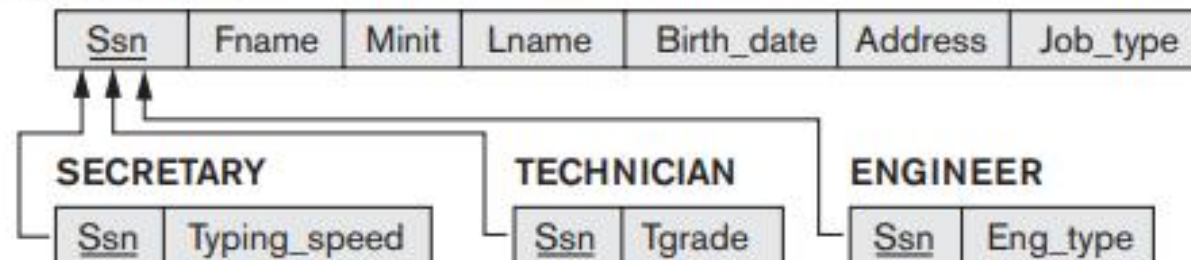


Figure 8.3

Generalization. (a) Two entity types, CAR and TRUCK. (b) Generalizing CAR and TRUCK into the superclass VEHICLE.

(a) EMPLOYEE



(b) CAR

<u>Vehicle_id</u>	License_plate_no	Price	Max_speed	No_of_passengers
-------------------	------------------	-------	-----------	------------------

TRUCK

<u>Vehicle_id</u>	License_plate_no	Price	No_of_axles	Tonnage
-------------------	------------------	-------	-------------	---------

(c) EMPLOYEE

<u>Ssn</u>	Fname	Minit	Lname	Birth_date	Address	Job_type	Typing_speed	Tgrade	Eng_type
------------	-------	-------	-------	------------	---------	----------	--------------	--------	----------

(d) PART

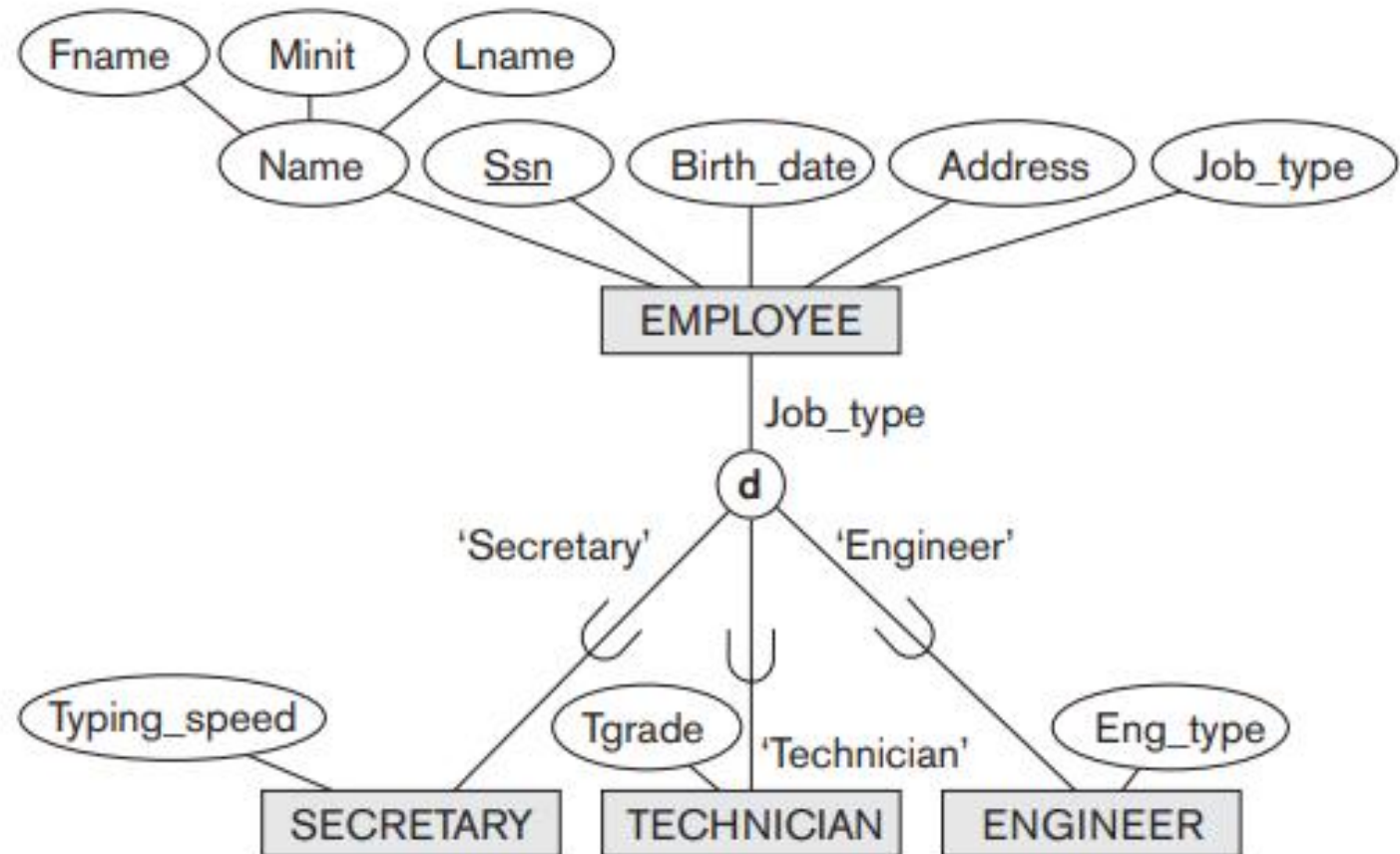
<u>Part_no</u>	Description	Mflag	Drawing_no	Manufacture_date	Batch_no	Pflag	Supplier_name	List_price
----------------	-------------	-------	------------	------------------	----------	-------	---------------	------------

Figure 9.5

Options for mapping specialization or generalization. (a) Mapping the EER schema in Figure 8.4 using option 8A. (b) Mapping the EER schema in Figure 8.3(b) using option 8B. (c) Mapping the EER schema in Figure 8.4 using option 8C. (d) Mapping Figure 8.5 using option 8D with Boolean type fields Mflag and Pflag.

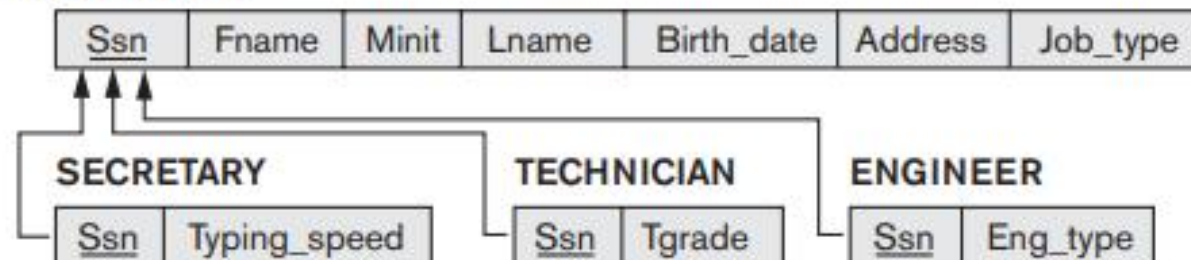
Figure 8.4

EER diagram notation for an attribute-defined specialization on Job_type.



⁶Such an attribute is called a *discriminator* in UML terminology.

(a) EMPLOYEE



(b) CAR

<u>Vehicle_id</u>	License_plate_no	Price	Max_speed	No_of_passengers
-------------------	------------------	-------	-----------	------------------

TRUCK

<u>Vehicle_id</u>	License_plate_no	Price	No_of_axles	Tonnage
-------------------	------------------	-------	-------------	---------

(c) EMPLOYEE

<u>Ssn</u>	Fname	Minit	Lname	Birth_date	Address	Job_type	Typing_speed	Tgrade	Eng_type
------------	-------	-------	-------	------------	---------	----------	--------------	--------	----------

(d) PART

<u>Part_no</u>	Description	Mflag	Drawing_no	Manufacture_date	Batch_no	Pflag	Supplier_name	List_price
----------------	-------------	-------	------------	------------------	----------	-------	---------------	------------

Figure 9.5

Options for mapping specialization or generalization. (a) Mapping the EER schema in Figure 8.4 using option 8A. (b) Mapping the EER schema in Figure 8.3(b) using option 8B. (c) Mapping the EER schema in Figure 8.4 using option 8C. (d) Mapping Figure 8.5 using option 8D with Boolean type fields Mflag and Pflag.

Single Relation - Multiple type attributes

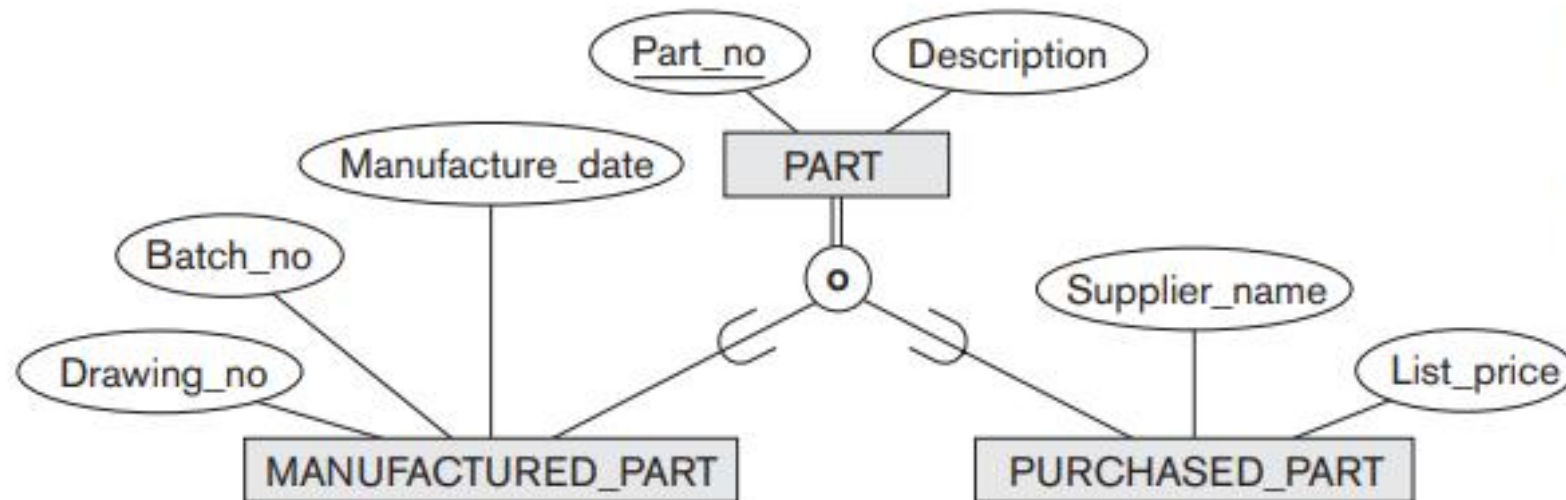
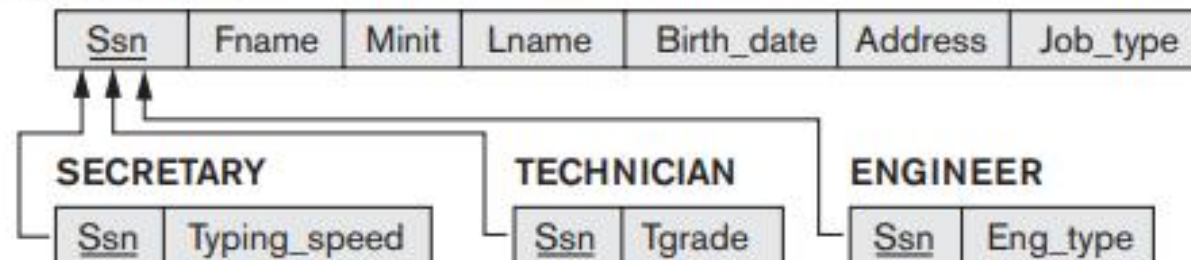


Figure 8.5
EER diagram notation
for an overlapping
(nondisjoint)
specialization.

⁷The notation of using single or double lines is similar to that for partial or total participation of an entity type in a relationship type, as described in Chapter 7.

(a) EMPLOYEE



(b) CAR

<u>Vehicle_id</u>	License_plate_no	Price	Max_speed	No_of_passengers
-------------------	------------------	-------	-----------	------------------

TRUCK

<u>Vehicle_id</u>	License_plate_no	Price	No_of_axles	Tonnage
-------------------	------------------	-------	-------------	---------

(c) EMPLOYEE

<u>Ssn</u>	Fname	Minit	Lname	Birth_date	Address	Job_type	Typing_speed	Tgrade	Eng_type
------------	-------	-------	-------	------------	---------	----------	--------------	--------	----------

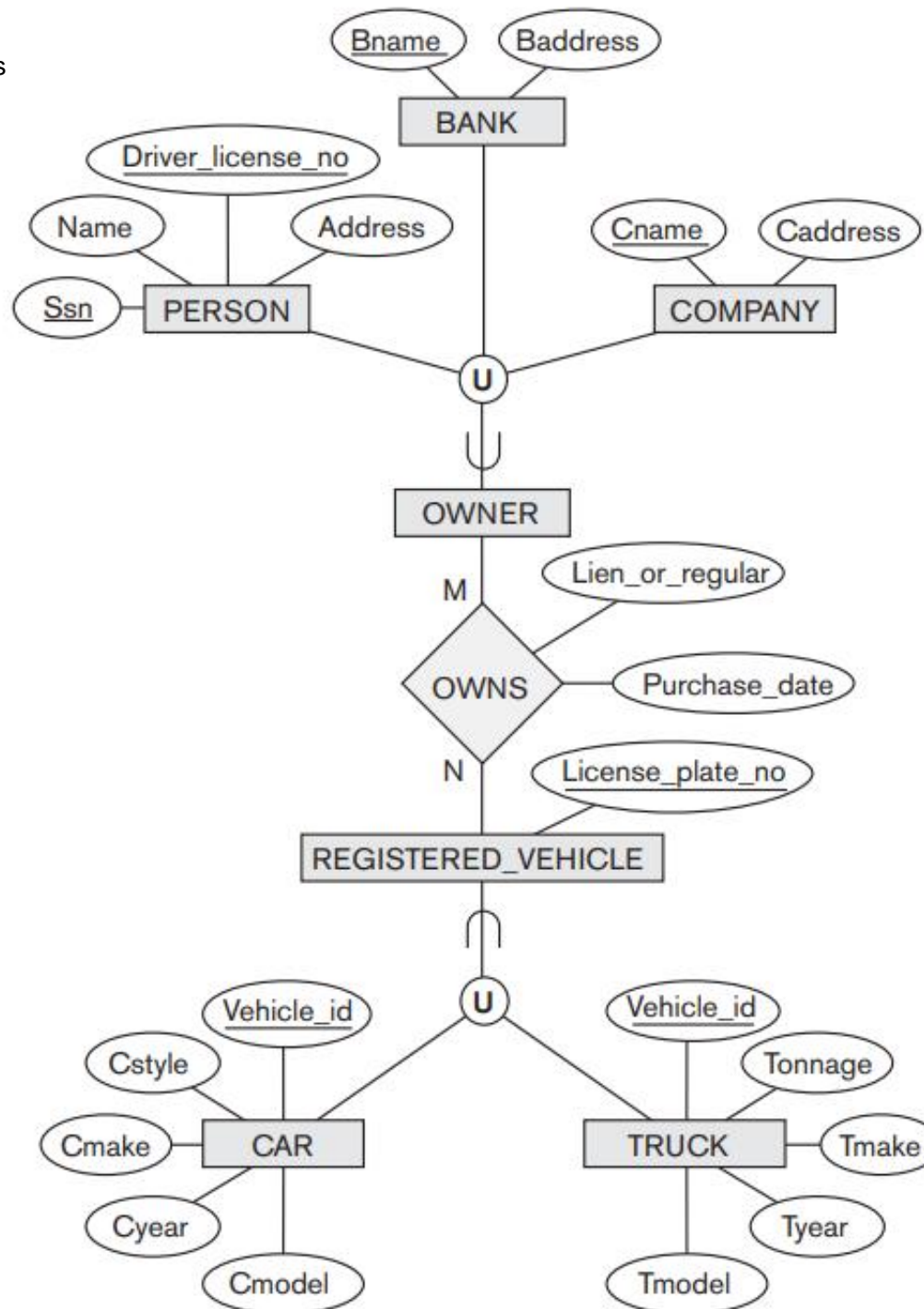
(d) PART

<u>Part_no</u>	Description	Mflag	Drawing_no	Manufacture_date	Batch_no	Pflag	Supplier_name	List_price
----------------	-------------	-------	------------	------------------	----------	-------	---------------	------------

Figure 9.5

Options for mapping specialization or generalization. (a) Mapping the EER schema in Figure 8.4 using option 8A. (b) Mapping the EER schema in Figure 8.3(b) using option 8B. (c) Mapping the EER schema in Figure 8.4 using option 8C. (d) Mapping Figure 8.5 using option 8D with Boolean type fields Mflag and Pflag.

Representation of union
with multiple Parent classes
with different primary keys

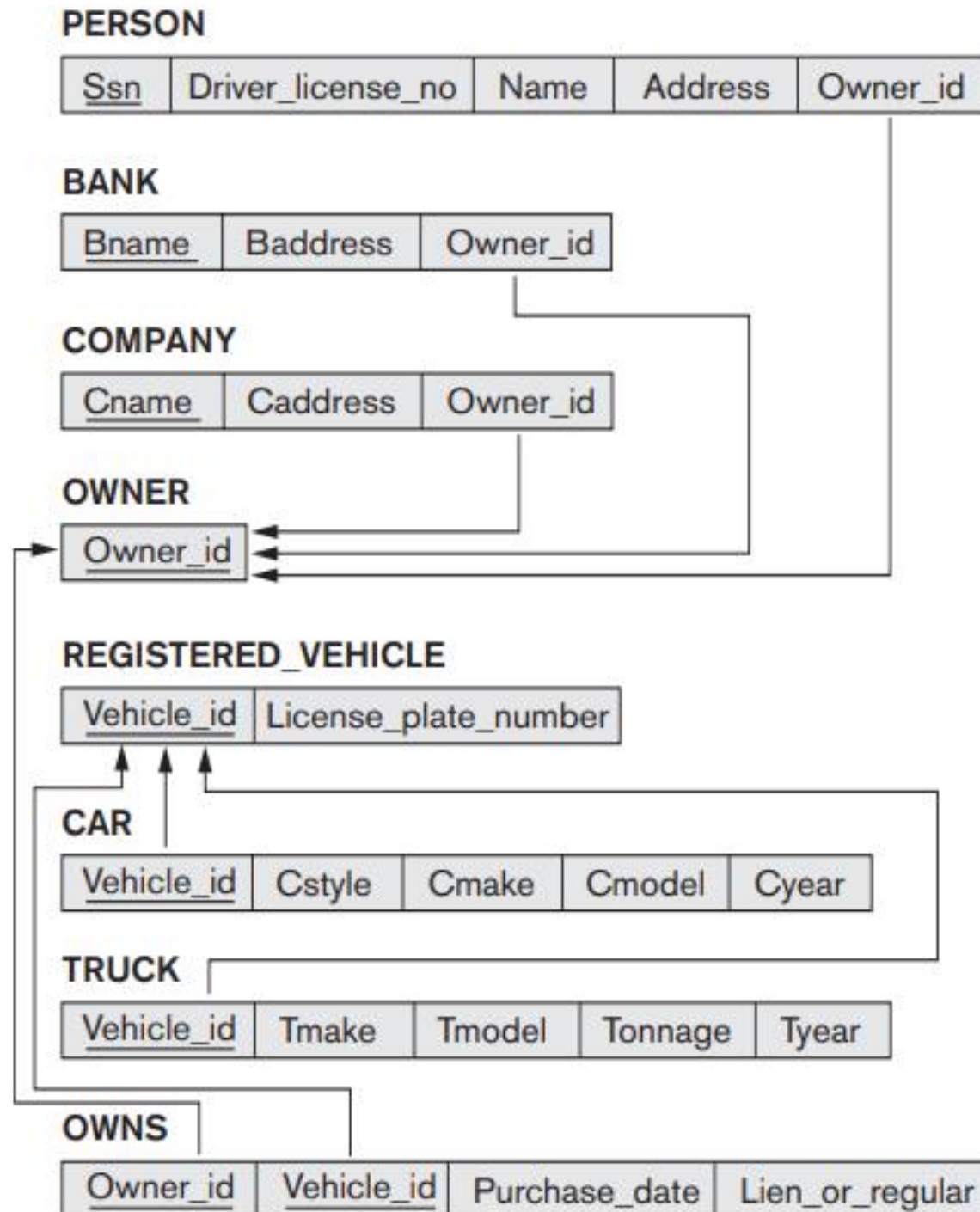


Note that REGISTERED_VEHICLE does not have parents with different primary keys.

Figure 8.8
Two categories (union
types): OWNER and
REGISTERED_VEHICLE.

Figure 9.7

Mapping the EER categories (union types) in Figure 8.8 to relations.



No need for surrogate key for CAR and TRUCK because they have the same primary key.

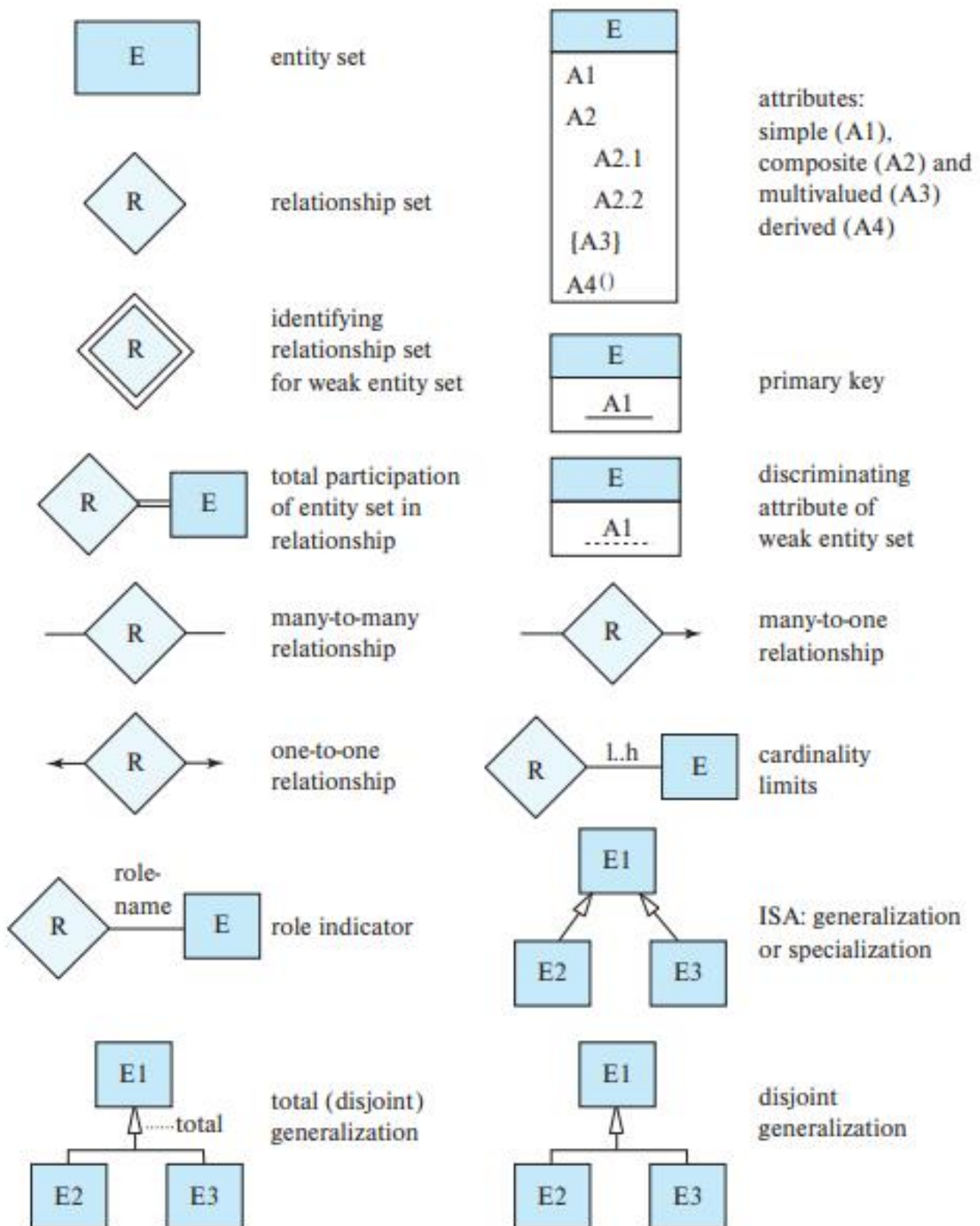
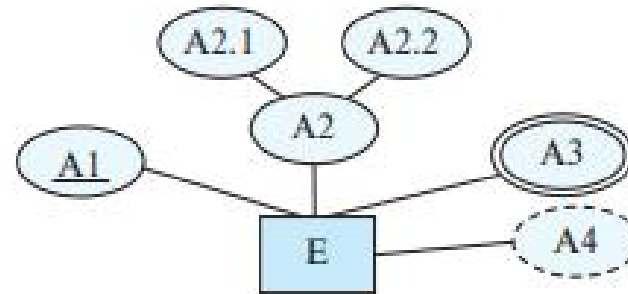
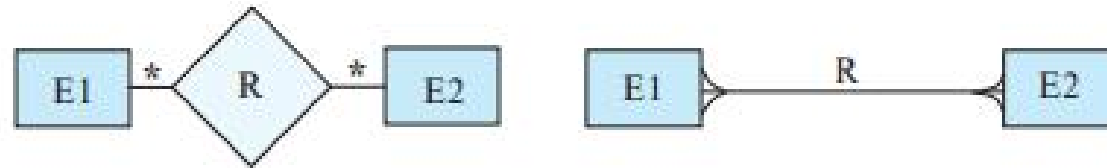


Figure 6.26 Symbols used in the E-R notation.

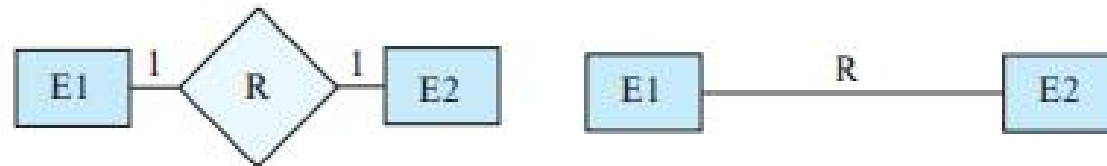
entity set E with
simple attribute A1,
composite attribute A2,
multivalued attribute A3,
derived attribute A4,
and primary key A1



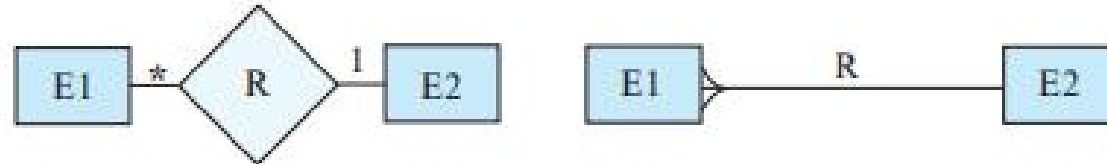
many-to-many
relationship



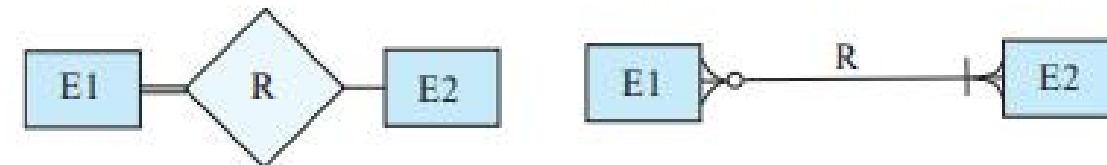
one-to-one
relationship



many-to-one
relationship



participation
in R: total (E1)
and partial (E2)

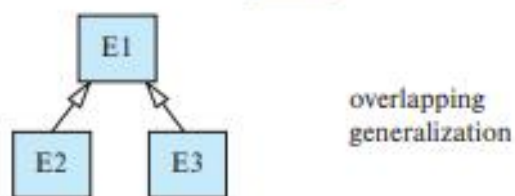
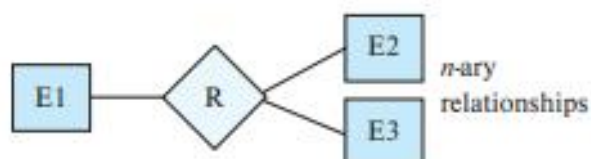
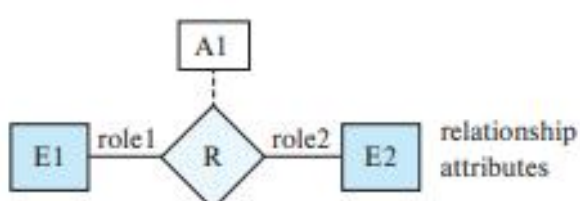
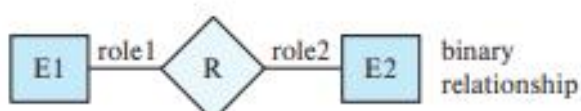
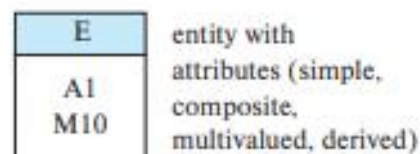


weak entity set



Figure 6.27 Alternative E-R notations.

ER Diagram Notation



Equivalent in UML

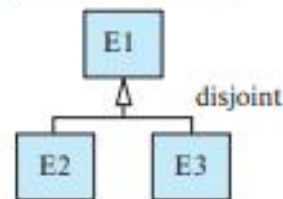
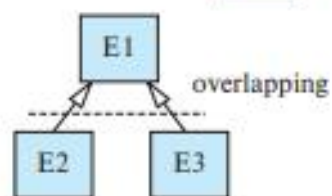
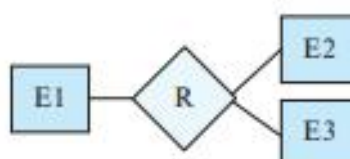
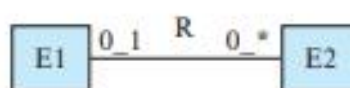
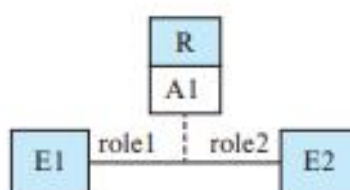
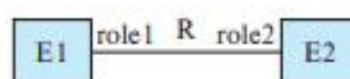
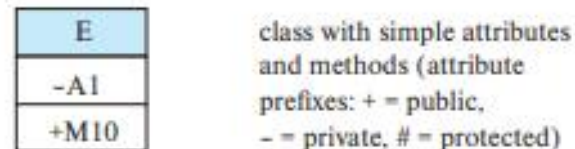


Figure 6.28 Symbols used in the UML class diagram notation.