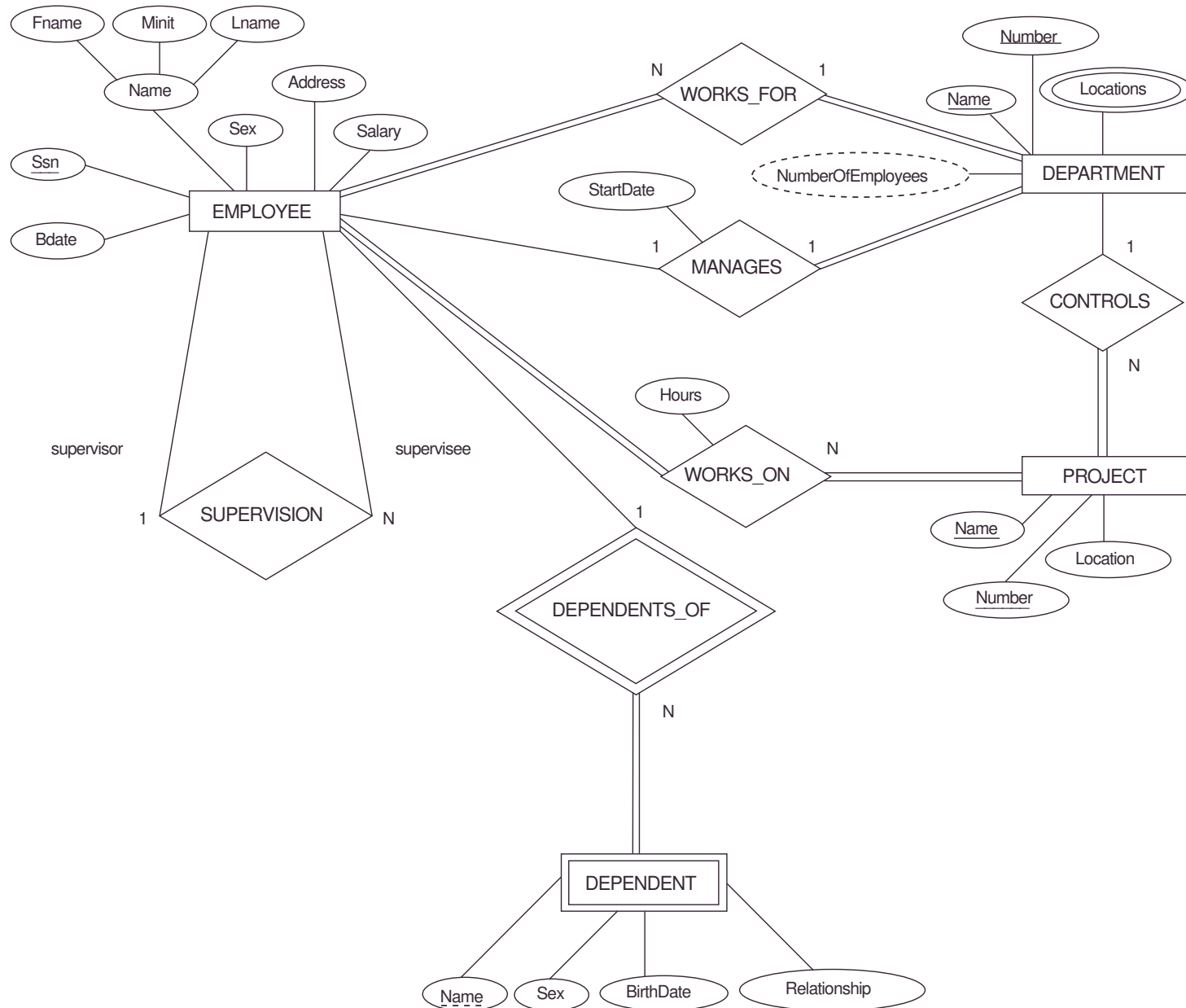# ER & EER to Relational Mapping

Figure 3.2 ER schema diagram for the company database.

Step 1: For each **regular entity type E**

- Create a relation R that includes all the simple attributes of E.

- Include all the simple component attributes of composite attributes.

- Choose one of the key attributes of E as primary key for R.

- If the chosen key of E is composite, the set of simple attributes that form it will together form the primary key of R.

Figure 7.5   Schema diagram for the COMPANY relational database schema; the primary keys are underlined.

EMPLOYEE

FNAME	MINIT	LNAME	SSN	BDATE	ADDRESS	SEX	SALARY	SUPERSSN	DNO

DEPARTMENT

DNAME	DNUMBER	MGRSSN	MGRSTARTDATE

DEPT_LOCATIONS

DNUMBER	DLOCATION

PROJECT

PNAME	PNUMBER	PLOCATION	DNUM

WORKS_ON

ESSN	PNO	HOURS

DEPENDENT

ESSN	DEPENDENT_NAME	SEX	BDATE	RELATIONSHIP

Step 2: For each **weak entity type W** with owner entity type E

- Create a relation R, and include all simple attributes and simple components of composite attributes of W as attributes of R.

- In addition, include as foreign key attributes of R the primary key attribute(s) of the relation(s) that correspond to the owner entity type(s).

Figure 7.5 Schema diagram for the COMPANY relational database schema; the primary keys are underlined.

EMPLOYEE

FNAME	MINIT	LNAME	SSN	BDATE	ADDRESS	SEX	SALARY	SUPERSSN	DNO

DEPARTMENT

DNAME	DNUMBER	MGRSSN	MGRSTARTDATE

DEPT_LOCATIONS

DNUMBER	DLOCATION

PROJECT

PNAME	PNUMBER	PLOCATION	DNUM

WORKS_ON

ESSN	PNO	HOURS

DEPENDENT

ESSN	DEPENDENT_NAME	SEX	BDATE	RELATIONSHIP

Step 3: For each **binary 1:1 relationship type R**

- Identify the relations S and T that correspond to the entity types participating in R. Choose one of the relations, say S, and include as foreign key in S the primary key of T.

- It is better to choose an entity type with total participation in R in the role of S.

- Include the simple attributes of the 1:1 relationship type R as attributes of S.

- If both participations are total, we may merge the two entity types and the relationship into a single relation.

Figure 7.5 Schema diagram for the COMPANY relational database schema; the primary keys are underlined.

EMPLOYEE

FNAME	MINIT	LNAME	SSN	BDATE	ADDRESS	SEX	SALARY	SUPERSSN	DNO

DEPARTMENT

DNAME	DNUMBER	MGRSSN	MGRSTARTDATE

DEPT_LOCATIONS

DNUMBER	DLOCATION

PROJECT

PNAME	PNUMBER	PLOCATION	DNUM

WORKS_ON

ESSN	PNO	HOURS

DEPENDENT

ESSN	DEPENDENT_NAME	SEX	BDATE	RELATIONSHIP

Step 4: For each **regular binary 1:N relationship type R**

- Identify the relation S that represents the participating entity type at the N-side of the relationship type.

- Include as foreign key in S the primary key of the relations T that represents the other entity type participating in R.

- Include any simple attributes of the 1:N relationship type as attributes of S.

Figure 7.5 Schema diagram for the COMPANY relational database schema; the primary keys are underlined.

EMPLOYEE

FNAME	MINIT	LNAME	SSN	BDATE	ADDRESS	SEX	SALARY	SUPERSSN	DNO

DEPARTMENT

DNAME	DNUMBER	MGRSSN	MGRSTARTDATE

DEPT_LOCATIONS

DNUMBER	DLOCATION

PROJECT

PNAME	PNUMBER	PLOCATION	DNUM

WORKS_ON

ESSN	PNO	HOURS

DEPENDENT

ESSN	DEPENDENT_NAME	SEX	BDATE	RELATIONSHIP

Step 5: For each **binary M:N relationship type R**

- Create a new relation S to represent R.

- Include as foreign key attributes in S the primary keys of the relations that represent the participating entity types; their combination will form the primary key of S.

- Also, include any simple attributes of the M:N relationship type as attributes of S.

Figure 7.5 Schema diagram for the COMPANY relational database schema; the primary keys are underlined.

EMPLOYEE

FNAME	MINIT	LNAME	SSN	BDATE	ADDRESS	SEX	SALARY	SUPERSSN	DNO

DEPARTMENT

DNAME	DNUMBER	MGRSSN	MGRSTARTDATE

DEPT_LOCATIONS

DNUMBER	DLOCATION

PROJECT

PNAME	PNUMBER	PLOCATION	DNUM

WORKS_ON

ESSN	PNO	HOURS

DEPENDENT

ESSN	DEPENDENT_NAME	SEX	BDATE	RELATIONSHIP

Step 6: For each **multi-valued attribute** A

- Create a new relation R that includes an attribute corresponding to A plus the primary key attribute K (as a foreign key in R) of the relation that represents the entity type or relationship type that has A as an attribute.

- The primary key of R is the combination of A and K. If a multi-valued attribute is composite, we include its components.

Figure 7.5 Schema diagram for the COMPANY relational database schema; the primary keys are underlined.

EMPLOYEE

FNAME	MINIT	LNAME	SSN	BDATE	ADDRESS	SEX	SALARY	SUPERSSN	DNO

DEPARTMENT

DNAME	DNUMBER	MGRSSN	MGRSTARTDATE

DEPT_LOCATIONS

DNUMBER	DLOCATION

PROJECT

PNAME	PNUMBER	PLOCATION	DNUM

WORKS_ON

ESSN	PNO	HOURS

DEPENDENT

ESSN	DEPENDENT_NAME	SEX	BDATE	RELATIONSHIP

Step 7: For each **n-ary relationship type R**, n>2

- Create a new relation S to represent R.

- Include as foreign key attributes in the S the primary keys of the relations that represent the participating entity types.

- Also include any simple attributes of the n-ary relationship types as attributes of S.

- The primary key for S is usually a combination of all the foreign keys that reference the relations representing the participating entity types.
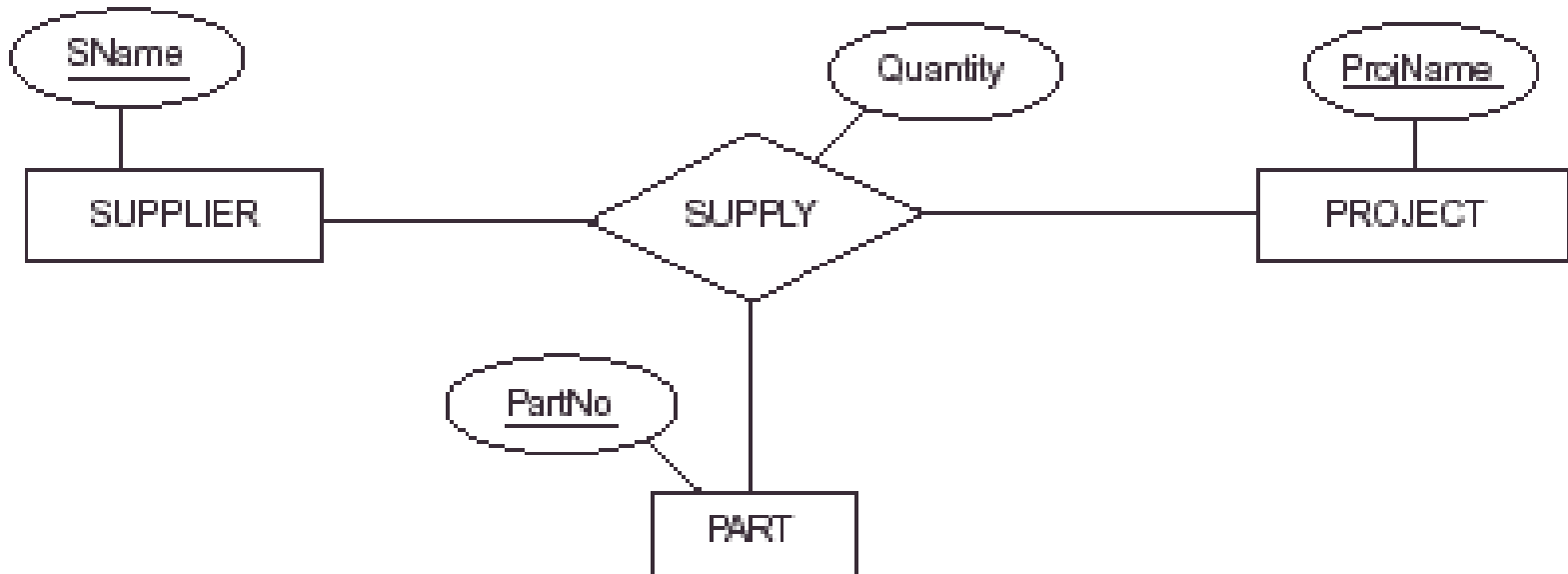
TERNARY RELATIONSHIPS

Figure 9.1 Mapping the n-ary relationship type SUPPLY from Figure 4.13(a).

SUPPLIER

SNAME	. . .

PROJECT

PROJNAME	. . .

PART

PARTNO	. . .

SUPPLY

SNAME	PROJNAME	PARTNO	QUANTITY

- However, if the participation constraint (min,max) of one of the entity types E participating in the R has max =1, then the primary key of S can be the single foreign key attribute that references the relation E' corresponding to E

- This is because , in this case, each entity e in E will participate in at most one relationship instance of R and hence can uniquely identify that relationship instance.

Step 8: To convert each **super-class/sub-class** relationship into a relational schema you must use one of the four options available.

Let C be the super-class, K its primary key and A_1, A_2, …, A_n its remaining attributes and let S_1, S_2, …, S_m be the sub-classes.

Option 8A (multiple relation option):

- Create a relation L for C with attributes
  Attrs(L) = {K, A$_1$, A$_2$, …, A$_n$} and PK(L) = K.

- Create a relation L$_i$ for each subclass S$_i$, $1 \leq i \leq m$, with the attributes
  ATTRS(L$_i$) = {K} U {attributes of S$_i$} and
  PK(L$_i$) = K.

- This option works for any constraints: disjoint or overlapping; total or partial.

Figure 4.4 An attribute-defined specialization on the JobType attribute of EMPLOYEE.
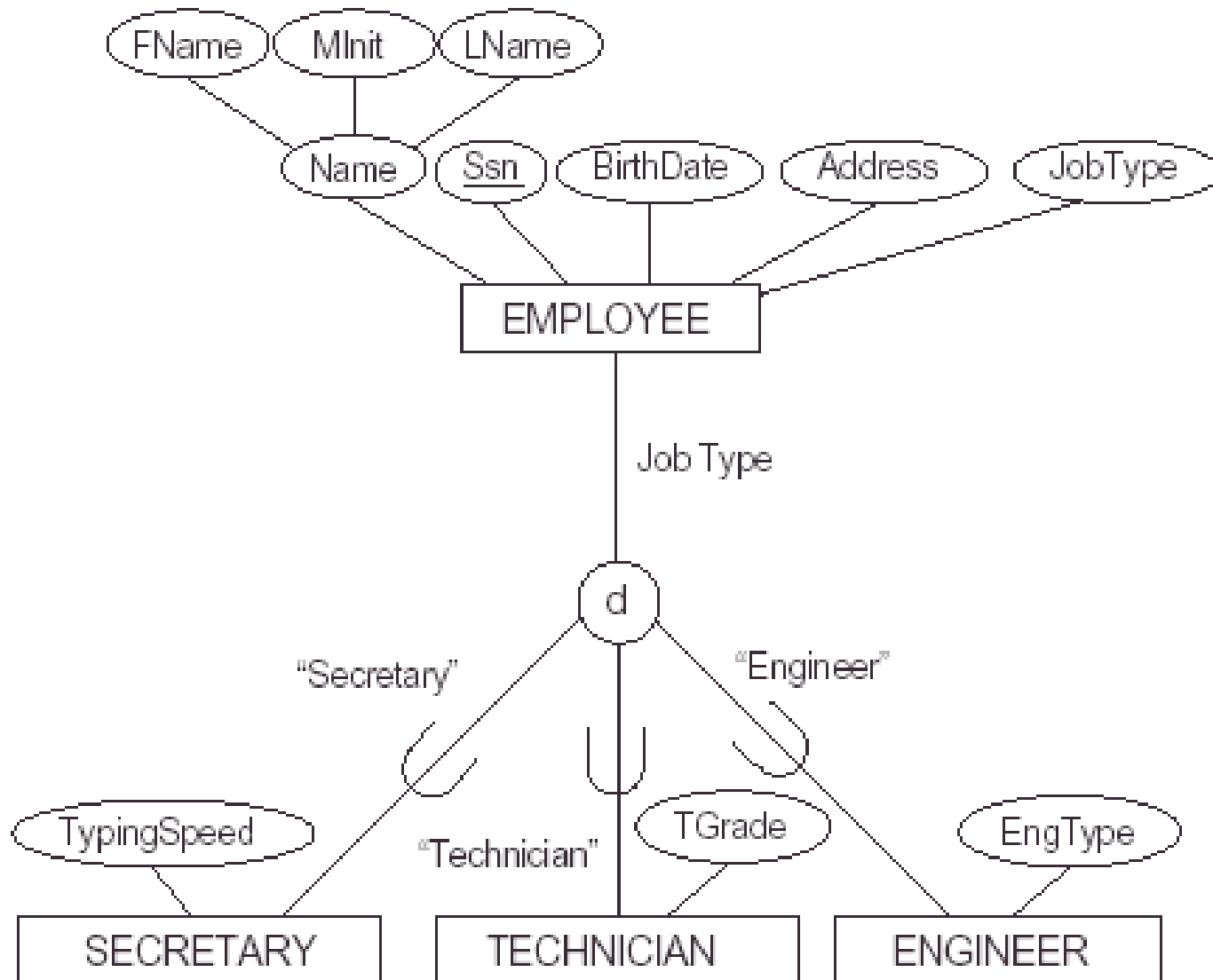
Figure 9.2 Options for mapping specializations (or generalizations) to relations. (a) Mapping the EER schema of Figure 4.4 to relations by using Option A. (b) Mapping the EER schema of Figure 4.3(b) into relations by using Option B. (c) Mapping the EER schema of Figure 4.4 by using Option C, with JobType playing the role of type attribute. (d) Mapping the EER schema of Figure 4.5 by using Option D, with two Boolean type fields Mflag and Pflag.

(a) EMPLOYEE

SSN	FName	MInit	LName	BirthDate	Address	JobType

SECRETARY

SSN	TypingSpeed

TECHNICIAN

SSN	TGrade

ENGINEER

SSN	EngType

(b) CAR

VehicleId	LicensePlateNo	Price	MaxSpeed	NoOfPassengers

TRUCK

VehicleId	LicensePlateNo	Price	NoOfAxles	Tonnage

(c) EMPLOYEE

SSN	FName	MInit	LName	BirthDate	Address	JobType	TypingSpeed	TGrade	EngType

(d) PART

PartNo	Description	MFlag	DrawingNo	ManufactureDate	BatchNo	PFlag	SupplierName	ListPrice