EER to Relational Mapping

Objectives

- Introduction +
- Non-shared class Mapping +
- Shared Class Mapping+
- Categories Mapping +
- Summary +

- Introduction

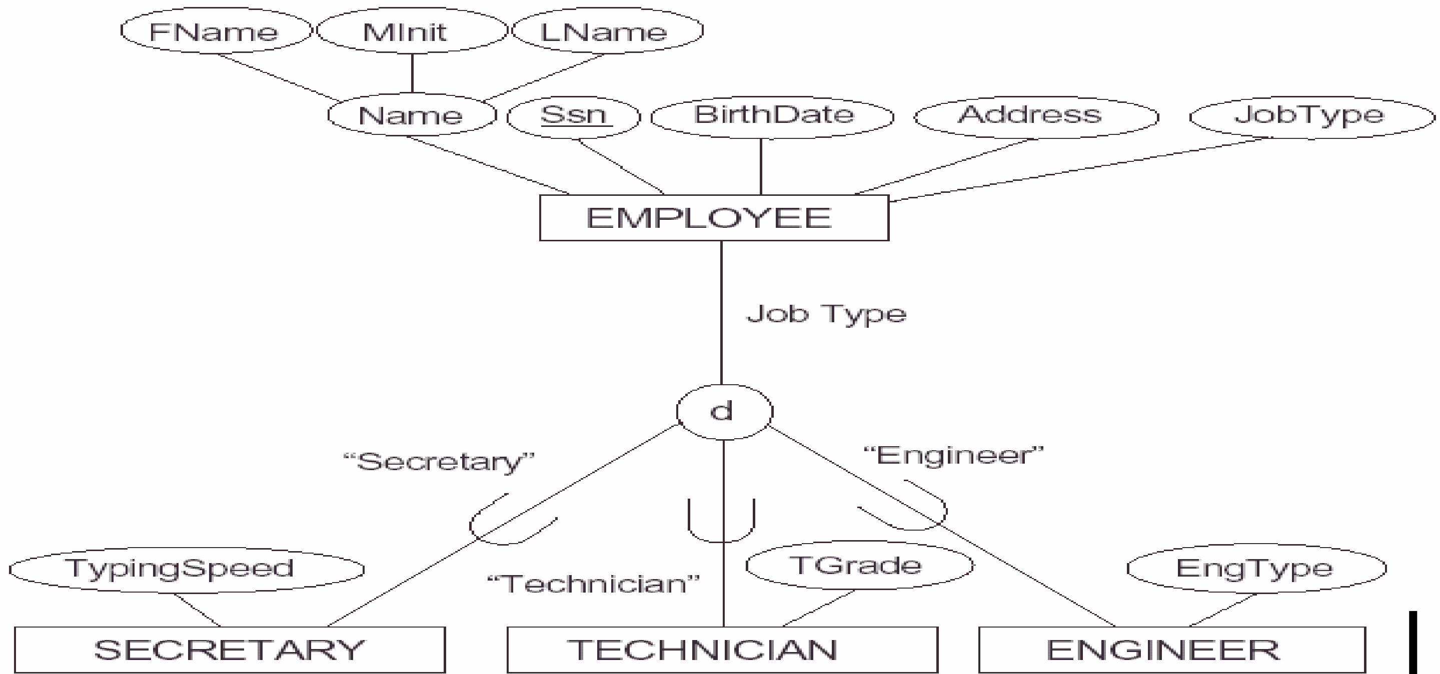
- In previous lecture we have looked at the mapping of ER diagram to relational schemas.
- In this lecture we will look at the mapping of the additional construct of EER diagrams to relational schemas.
- We start by discussing the mapping of the superclass/subclass relationship. After that we will look at the shared subclasses mapping. Finally we will look at the categories mapping.

- Non-Shared Classes Mapping

- Now we will look at the mapping of specialization with m subclasses $\{S_1, S_2, \ldots, S_m\}$ and (generalized) superclass C, where the attributes of C are $\{k, a_1, a_2, \ldots, a_n\}$ and k is the primary key, into relational schemas.
- There are four options (A, B, C, or D) as will be described later.
  - Options A and B: also called the multiple relations options, produce multiple relations to map the superclass/subclass relationship.
  - Options C and D: also called the single relation options, produce only a single relation to map the superclass/subclass relationship.

-- Option A

- 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 <= I <= m, with the attributes Attrs(L_i) = {k} U {attributes of S_i} and PK(L_i) = k.
- Each L_i includes the specific (or local) attributes of S_i, plus the primary key of the superclass C, which is propagated to L_i and becomes its primary key.
- An EQUIJOIN operation on the primary key between any L_i and L produces all the specific and inherited attributes of the entities in S_i.
- The following figure shows how option A is used to map the EMPLOYEE superclass/subclass relationship.



EER

REL.

EMPLOYEE

<u>SSN</u>	Fname	Minit	Lname	Bdate	Address	Jobtype

SECRETARY

<u>SSN</u>	TypingSpeed

TECHNICIAN

<u>SSN</u>	TGrade

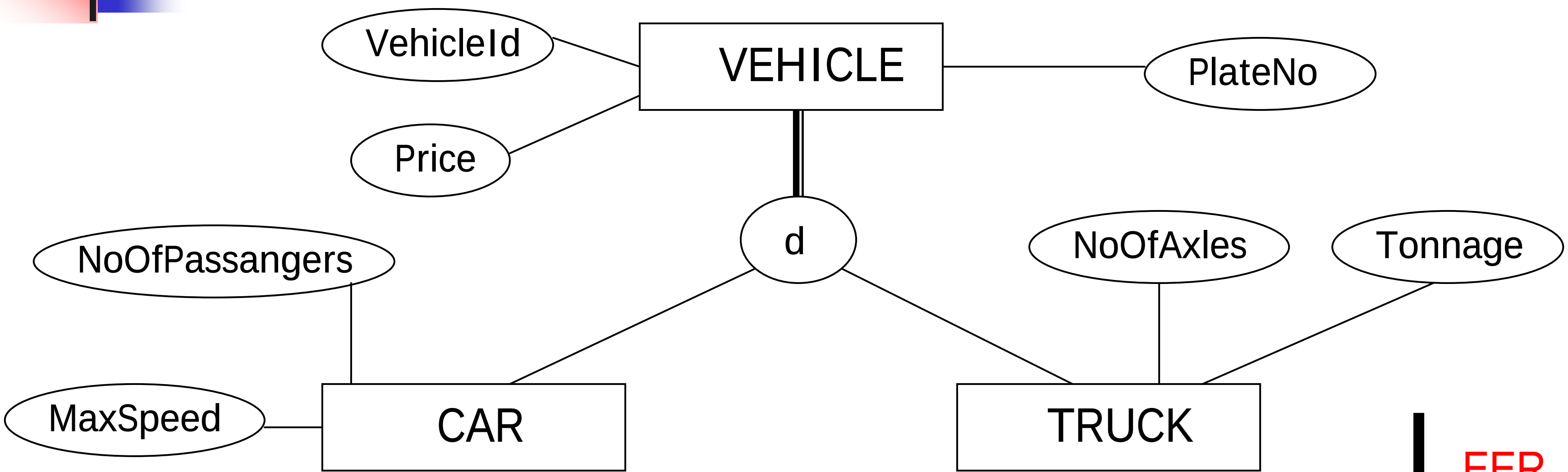
ENGINEER

<u>SSN</u>	EngType

-- Option B

- Create a relation L_i for each subclass S_i; 1 <= I <= m, with Attrs(L_i) = {attributes of S_i} U {k, a_1, a_2, ..., a_n} and PK(L_i) = k.

--- Example: Option B



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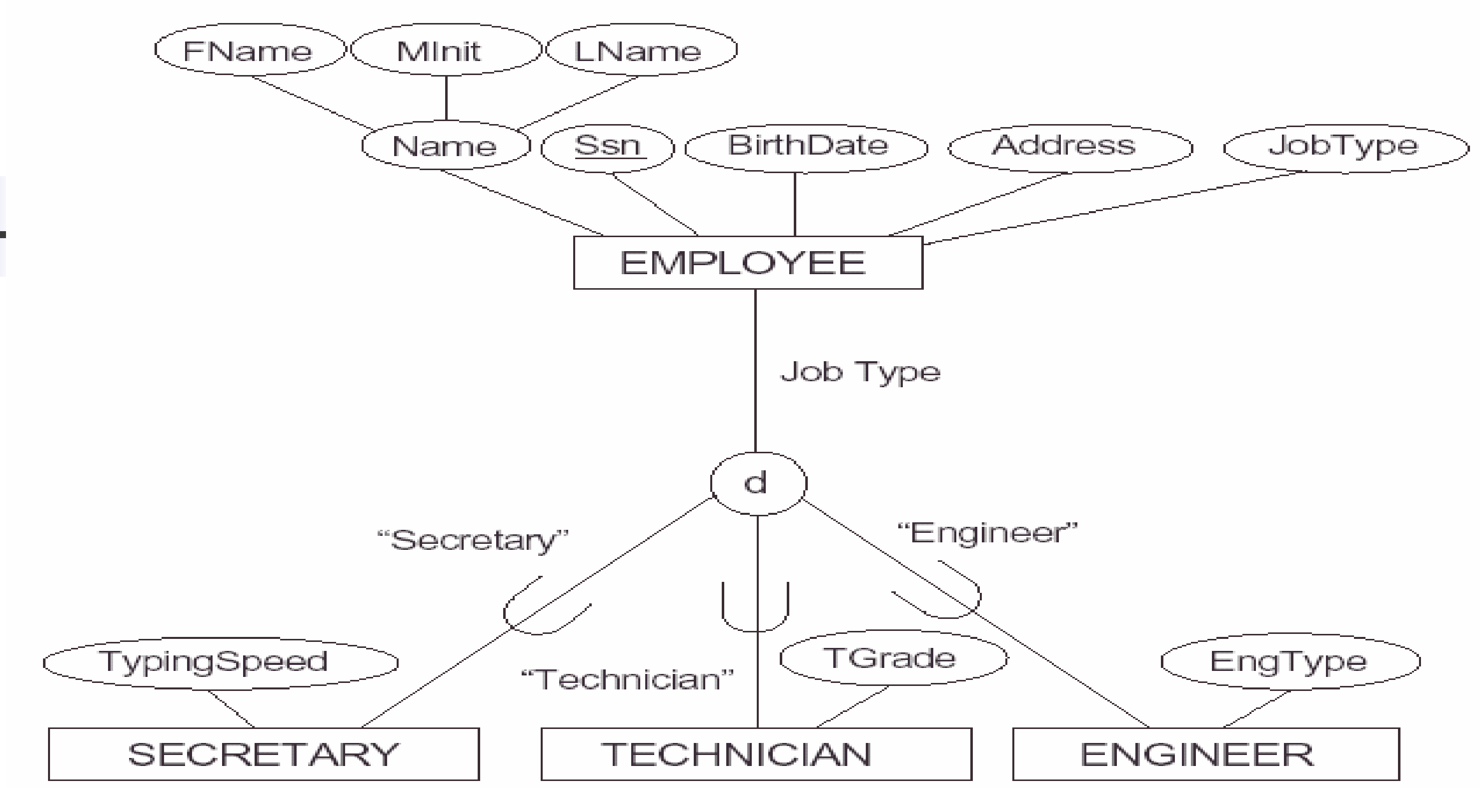
CAR	VehicleId	PlateNo	Price	NoOfPassangers	MaxSpeed

TRUCK	VehicleId	PlateNo	Price	NoOfAxles	Tonnage

-- Option C (Disjoint Subclasses)

- Create a single relation L with attributes Attrs(L) = {k, a_1, a_2, ..., a_n} U {attributes of S_1} U . . . {attributes of S_m} U {t} and PK(L) = k.
- This option is for specialization whose subclasses are disjoint, and *t* is a type (or discriminating) attribute that indicates the subclass to which each tuple belongs, if any.
- This option has the potential for generating a large number of null values



EER

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EMPLOYEE

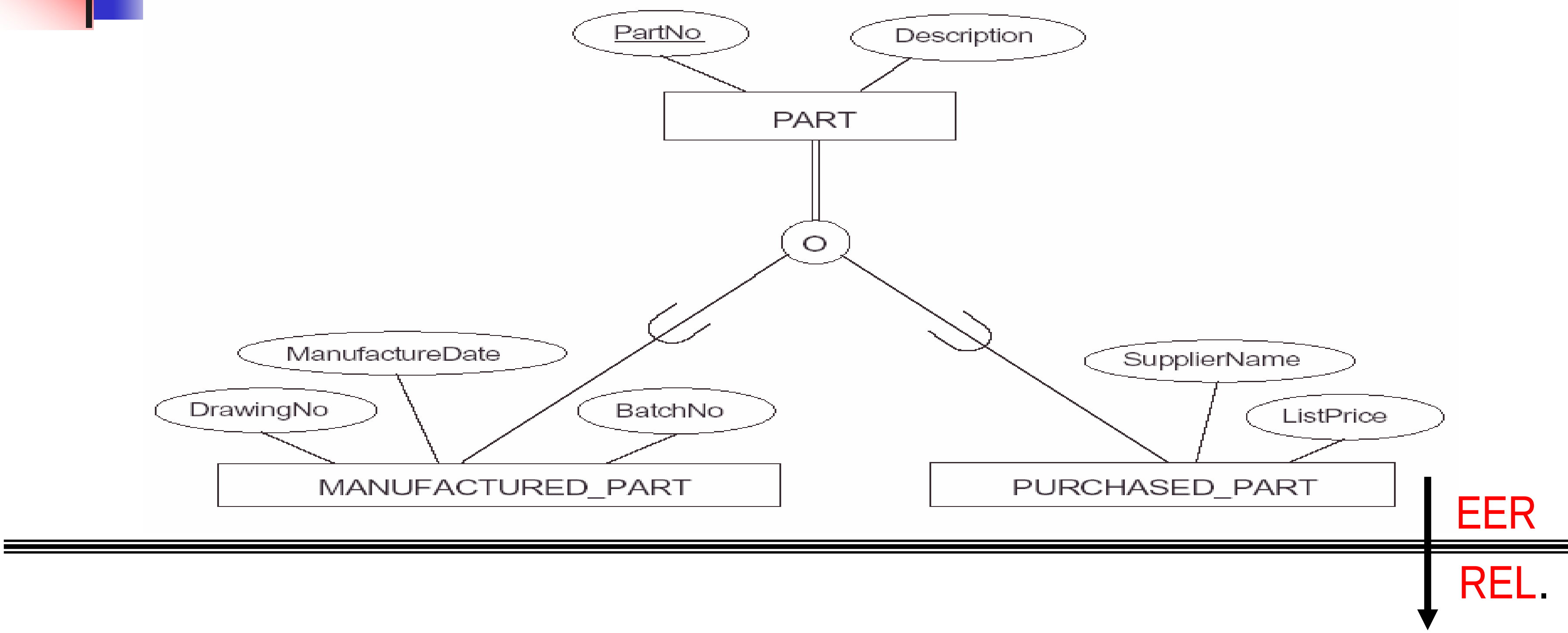
SSN	Fname	Minit	Lname	Bdate	Address	Jobtype	TGrade	EngType	TypingSpeed

-- Option D (Overlapping Subclasses)

- Create a single relation schema L with attributes Attrs(L) = {k, a_1, a_2, ..., a_n} U {attributes of S_1} U . . . U {attributes of S_m} U {t_1, t_2, . . ., t_m} and PK(L) = k.

- This option is for specialization whose subclasses are overlapping (but will also work for a disjoint specialization), and each t_i, 1 <= I <= m, is a boolean attribute indicating whether a tuple belongs to subclass S_i.

--- Example: Option D



PART

<u>PartNo</u>	Description	MFlag	DrawingNo	ManufactureDate	BatchNo	PFlag	SupplierName	ListPrice

- Shared Class Mapping

- As it was stated during the discussion of EER concepts, a shared subclass is a subclass of several superclasses, such as ENGINEERING_MANAGER. These classes must all have the same key attribute; otherwise, the shared subclass would be modeled as a category, which will be discussed later.

- We can apply any of the options discussed in the previous step to a shared subclass, although usually option A is used.

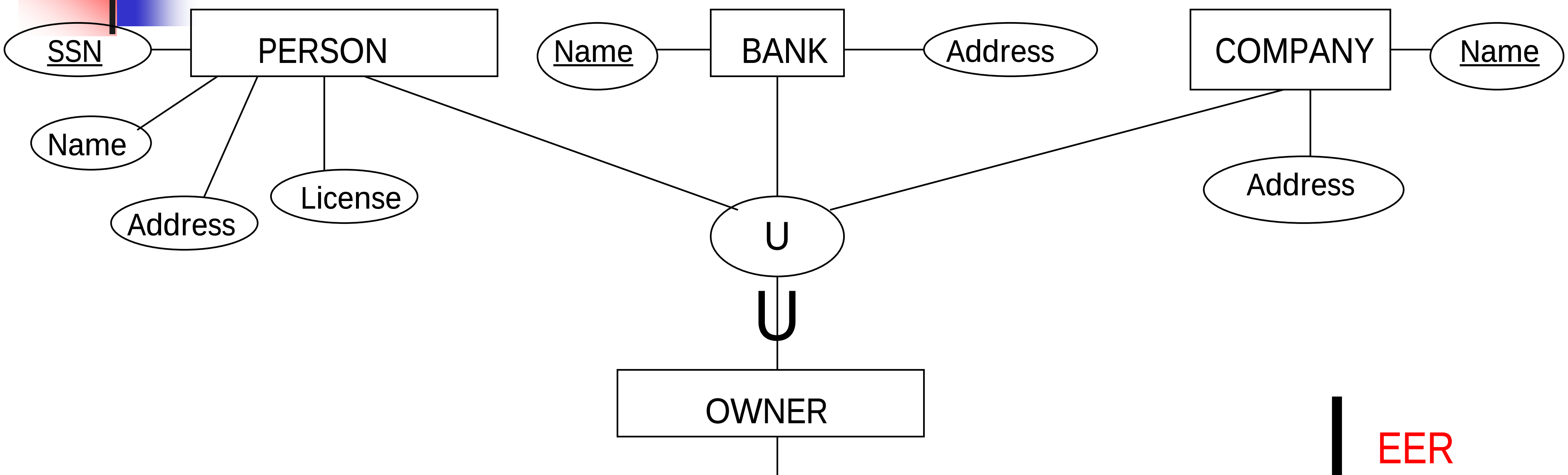
- Category Mapping ...

- A category is a subclass of the union of two or more superclasses that can have different keys because they can be of different entity types.
- An example is the OWNER category shown in the following figure, which is a subset of the union of three entity types PERSON, BANK, and COMPANY. The other category in that figure, REGISTERED_VEHICLE, has two superclasses that have the same key attribute.
- For mapping a category whose defining superclass have different keys, it is customary to specify a new key attribute, called a surrogate key, when a relation to correspond to the category. This is because the keys of the defining classes are different, so we cannot use any one of them exclusively to identify all entities in the category.

... - Category Mapping

- We can now create a relation schema OWNER to correspond to the OWNER category, as illustrated in, and include any attributes of the category in this relation.
- The primary key of OWNER is the surrogate key OwnerId. We also add the surrogate key attribute OwnerId as a foreign key to each relation corresponding to a superclass of the category, to specify the correspondence in valued between the surrogate key and the key of each superclass.
- For a category whose superclasses have the same key, such as VEHICLE in the figure, there is no need for a surrogate key. The mapping of the REGISTERED_VEHICLE category, which illustrates this case, is also shown in the mapping figure.

--- Example: Category Mapping



EER

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PERSON

SSN	License	Name	Address	OwnerId

BANK

BName	BAddress	OwnerId

COMPANY

CName	CAddress	OwnerId

OWNER

OwnerId

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

Figure 7.7 Referential integrity constraints displayed on the COMPANY relational database schema diagram.

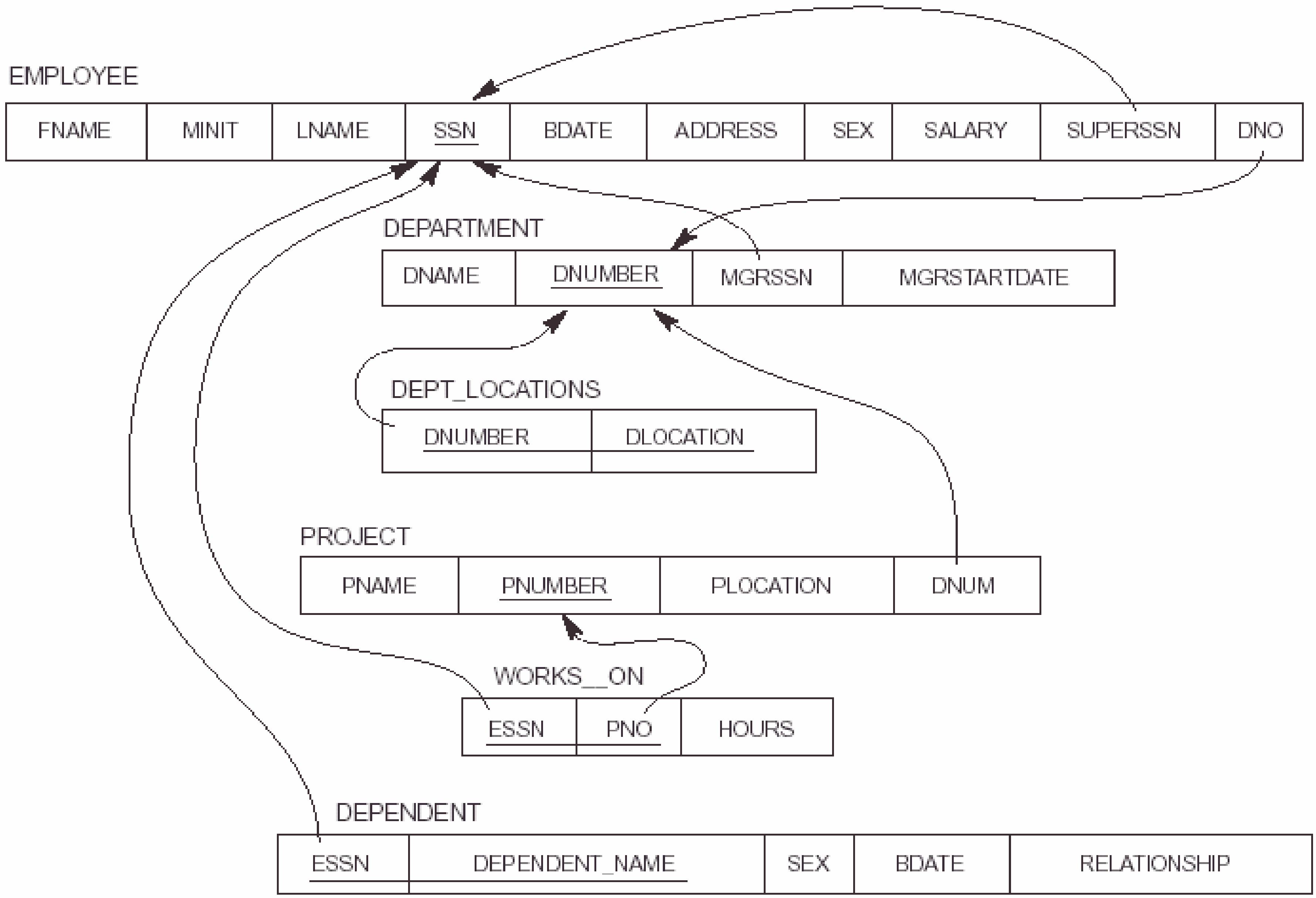

Figure 7.6 One possible relational database state corresponding to the COMPANY schema.

EMPLOYEE	FNAME	MINIT	LNAME	SSN	BDATE	ADDRESS	SEX	SALARY	SUPERSSN	DNO
	John		Smith	123456789	1965-01-09	731 Fondren, Houston, TX	M	30000	333445555	5
	Franklin		Wong	333445555	1955-12-08	638 Voss, Houston, TX	M	40000	888665555	5
	Alicia		Zelaya	999887777	1968-01-19	3321 Castle, Spring, TX	F	25000	987654321	4
	Jennifer		Wallace	987654321	1941-06-20	291 Berry, Bellaire, TX	F	43000	888665555	4
	Ramesh		Narayan	666884444	1962-09-15	975 Fire Oak, Humble, TX	M	38000	333445555	5
	Joyce		English	453453453	1972-07-31	5631 Rice, Houston, TX	F	25000	333445555	5
	Ahmad		Jabbar	987987987	1969-03-29	980 Dallas, Houston, TX	M	25000	987654321	4
	James		Borg	888665555	1937-11-10	450 Stone, Houston, TX	M	55000	null	1

DEPT_LOCATIONS	DNUMBER	DLOCATION
		Houston
		Stafford
		Bellaire
		Sugarland

DEPARTMENT	DNAME	DNUMBER	MGRSSN	MGRSTARTDATE
	Research	5	333445555	1988-05-22
	Administration	4	987654321	1995-01-01
	Headquarters	1	888665555	1981-06-19

WORKS_ON	ESSN	PNO	HOURS
	123456789	1	32.5
	123456789	2	7.5
	666884444	3	40.0
	453453453	1	20.0
	453453453	2	20.0
	333445555	2	10.0
	333445555	3	10.0
	333445555	10	10.0
	333445555	20	10.0
	999887777	30	30.0
	999887777	10	10.0
	987987987	10	35.0
	987987987	30	5.0
	987654321	30	20.0
	987654321	20	15.0
	888665555	20	null

PROJECT	PNAME	PNUMBER	PLOCATION	DNUM
	ProductX	1	Bellaire	5
	ProductY	2	Sugarland	5
	ProductZ	3	Houston	5
	Computerization	10	Stafford	4
	Reorganization	20	Houston	1
	Newbenefits	30	Stafford	4

DEPENDENT	ESSN	DEPENDENT_NAME	SEX	BDATE	RELATIONSHIP
	333445555	Alice	F	1986-04-05	DAUGHTER
	333445555	Theodore	M	1983-10-25	SON
	333445555	Joy	F	1958-05-03	SPOUSE
	987654321	Abner	M	1942-02-28	SPOUSE
	123456789	Michael	M	1988-01-04	SON
	123456789	Alice	F	1988-12-30	DAUGHTER
	123456789	Elizabeth	F	1967-05-05	SPOUSE