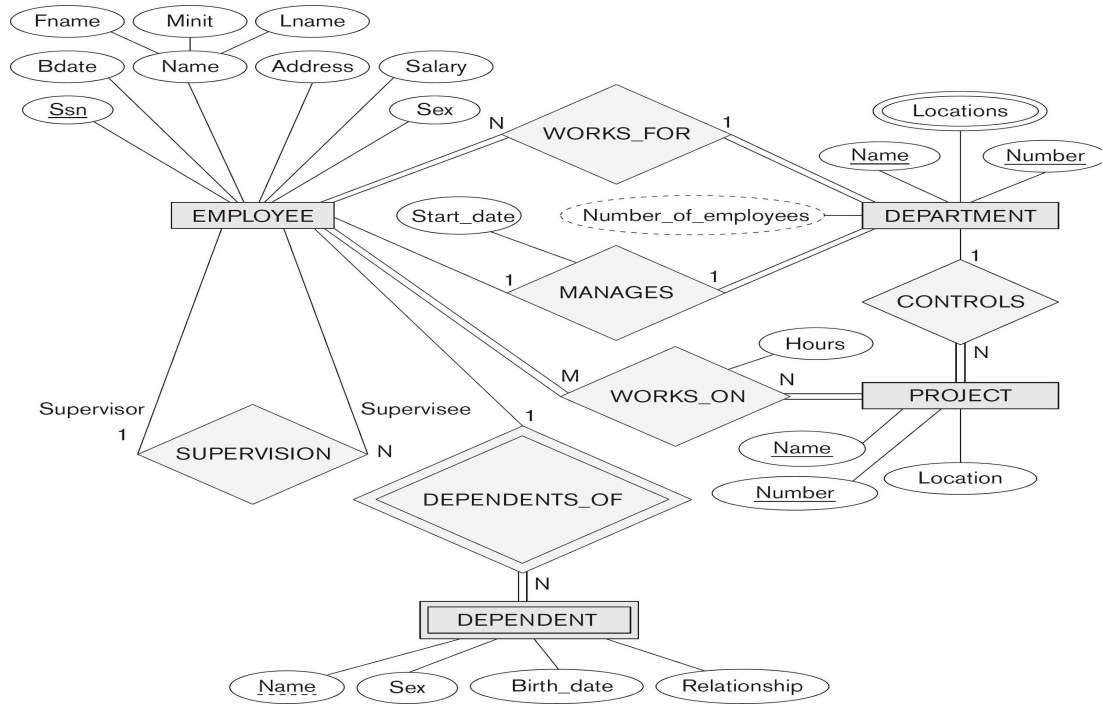
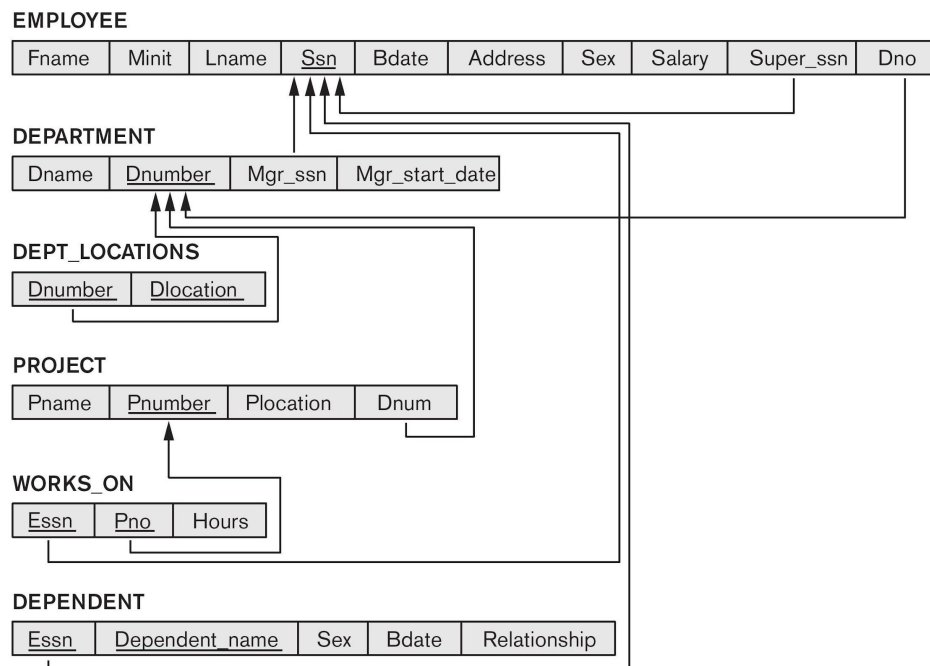


Example



2

Resulting Relational Schema



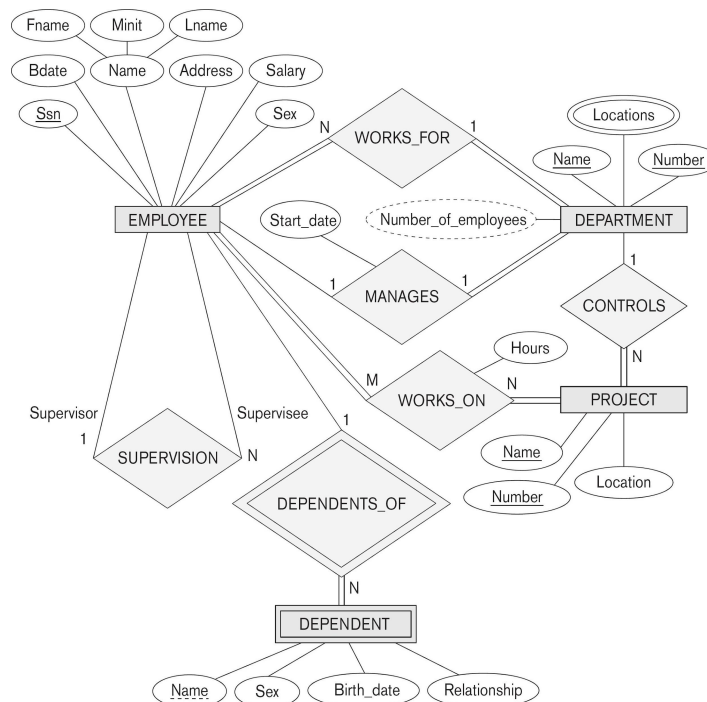
3

Step 1: Regular Entity Types

- i. For regular/strong entity type, create a corresponding relation that includes all the simple attributes (includes simple attributes of composite relations)
- ii. Choose one of the key attributes as primary
 - If composite, the simple attributes together form the primary key
- iii. Any remaining key attributes are kept as secondary unique keys (these will be useful for physical tuning w.r.t. indexing analysis)

4

Example



5

Step 1 Result

EMPLOYEE

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

DEPARTMENT

Dname	<u>Dnumber</u>
-------	----------------

PROJECT

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

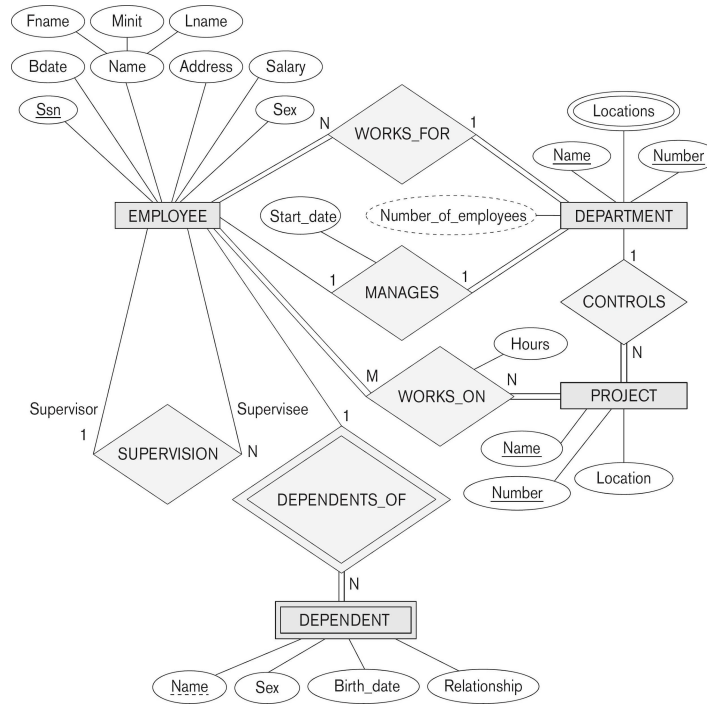
6

Step 2: Weak Entity Types

- i. For weak entity type, create a corresponding relation that includes all the simple attributes
- ii. Add as a foreign key all of the primary key attribute(s) in the entity corresponding to the owner entity type
- iii. The primary key is the combination of all the primary key attributes from the owner and the partial key of the weak entity, if any

7

Example



8

Step 2 Result

EMPLOYEE

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

DEPARTMENT

Dname	<u>Dnumber</u>
-------	----------------

PROJECT

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

DEPENDENT

<u>Essn</u>	<u>Dependent_name</u>	Sex	Bdate	Relationship
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9

Step 3: Mapping Binary 1-to-1

Three approaches

- **Foreign Key**
 - Usually appropriate
- Merged Relation
 - Possible when both participations are total
- Relationship Relation
 - Not discussed

10

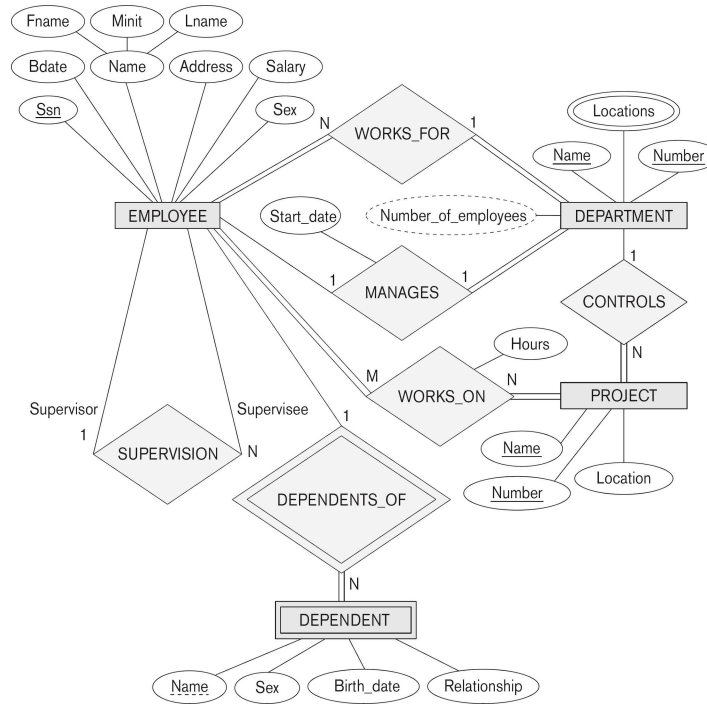
Step 3: Mapping Binary 1-to-1

Foreign Key

- i. Choose one relation as S , the other T
 - Better if S has total participation (reduces number of NULL values)
- ii. Add to S all the simple attributes of the relationship
- iii. Add as a foreign key in S the primary key attributes of T

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Example



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Step 2 Result

EMPLOYEE

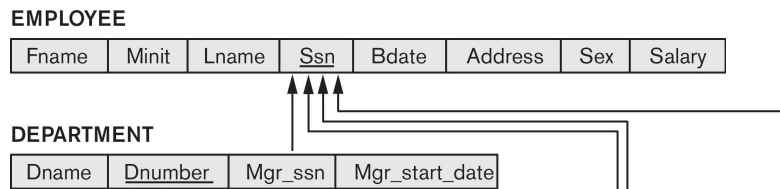
Fname	Minit	Lname	<u>Ssn</u>	Bdate	Address	Sex	Salary
-------	-------	-------	------------	-------	---------	-----	--------

DEPARTMENT

Dname	<u>Dnumber</u>
-------	----------------

13

Step 3 Result



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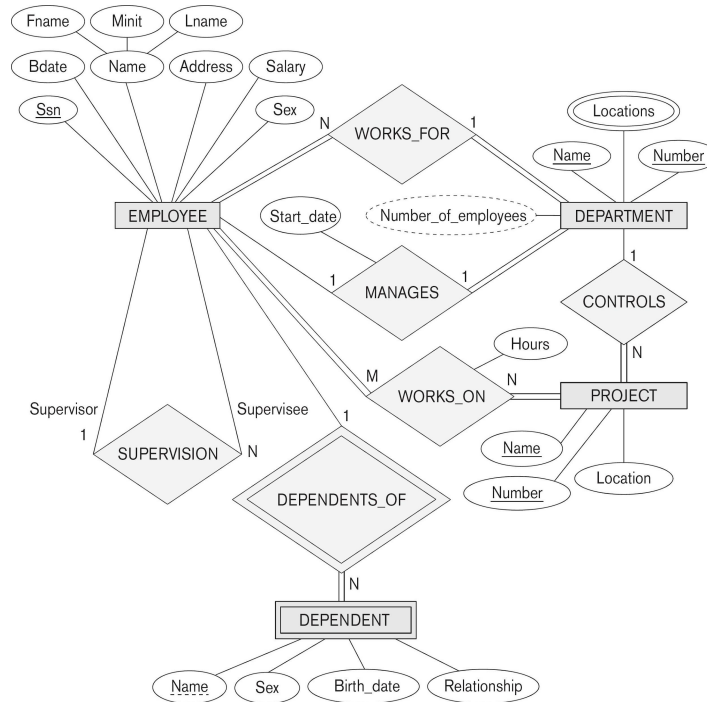
Step 4: Binary 1-to-N

- i. Choose the *S* relation as the type at the N-side of the relationship, other is *T*
- ii. Add as a foreign key to *S* all of the primary key attribute(s) of *T*

Another approach: create a relationship relation

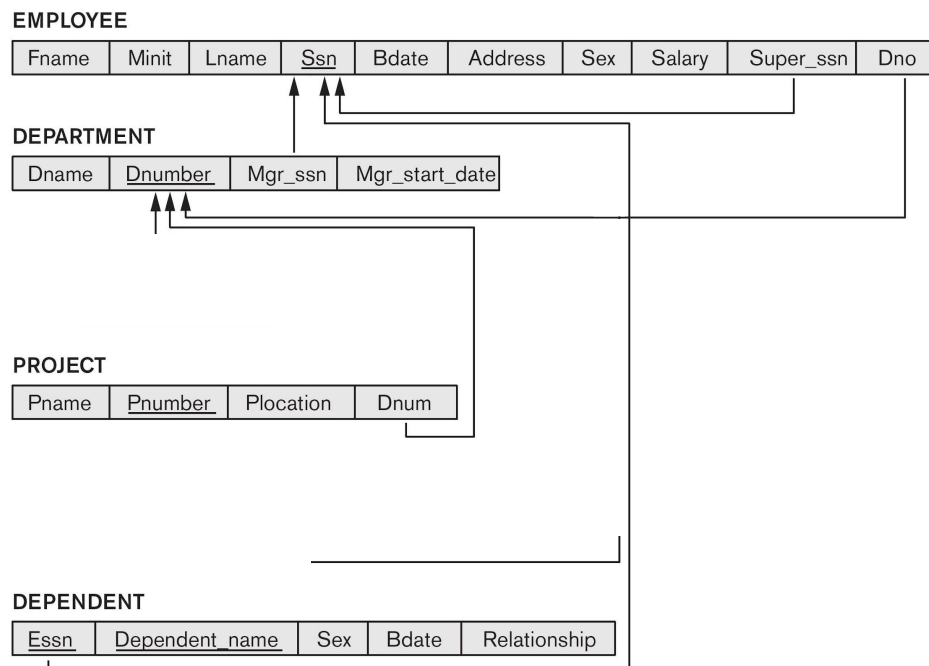
15

Example



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Step 4 Result



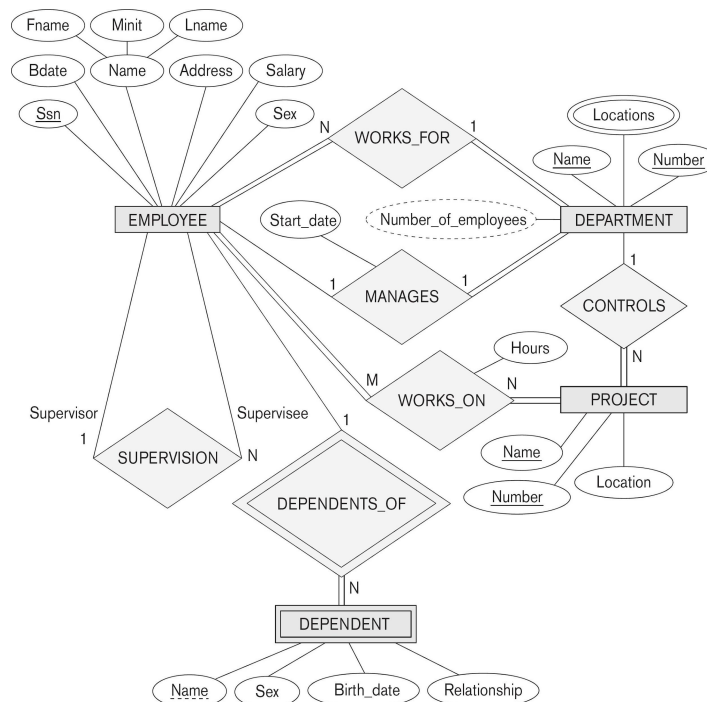
17

Step 5: Binary M-to-N

- i. Create a new relation S (termed: *relationship relation*)
 - In some ERD dialects, actually drawn in
- ii. Add as foreign keys the primary keys of both relations; their combination forms the primary key of S
- iii. Add any simple attributes of the M:N relationship to S

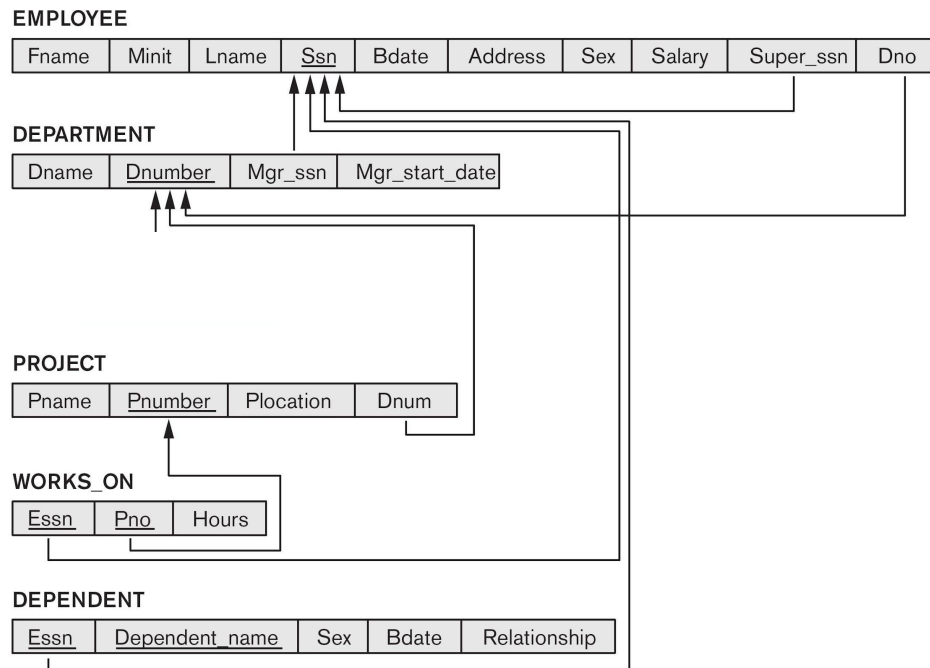
18

Example



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Step 5 Result



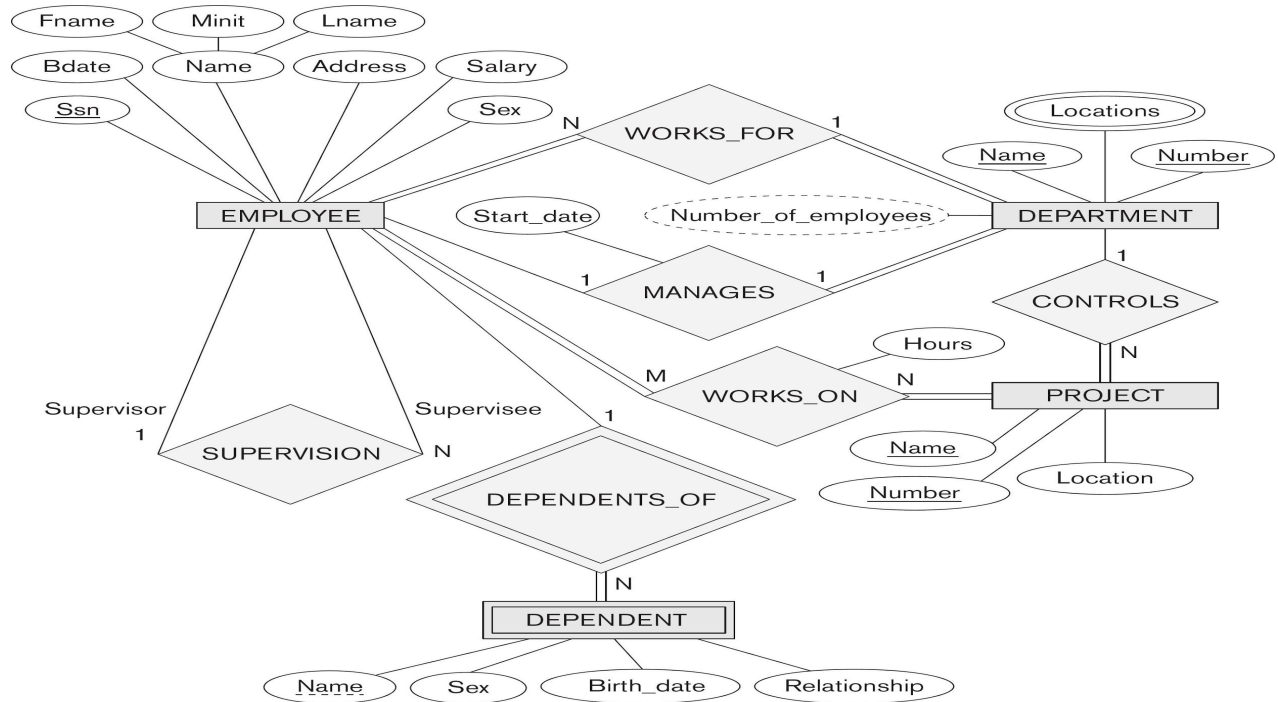
20

Step 6: Multivalued Attributes

- i. Create a new relation S
- ii. Add as foreign keys the primary keys of the corresponding relation
- iii. Add the attribute to S (if composite, the simple attributes); the combination of all attributes in S forms the primary key

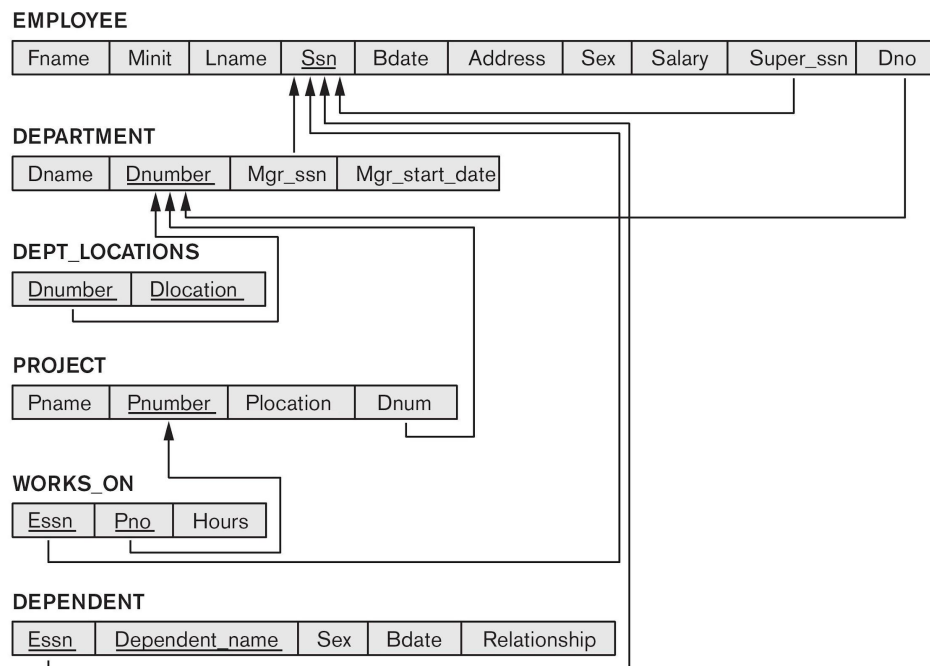
21

Example



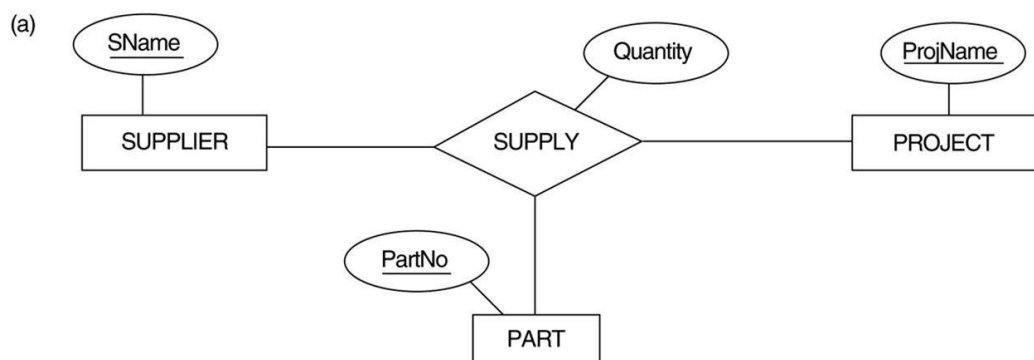
22

Step 6 Result



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- **Step 7: Mapping of N-ary Relationship Types.**
 - For each n-ary relationship type R, where $n > 2$, create a new relationship S to represent R.
 - Include as foreign key attributes in S the primary keys of the relations that represent the participating entity types.
 - Also include any simple attributes of the n-ary relationship type (or simple components of composite attributes) as attributes of S.
- **Example:** The relationship type SUPPLY in the ER on the next slide.
 - This can be mapped to the relation SUPPLY shown in the relational schema, whose primary key is the combination of the three foreign keys {SNAME, PARTNO, PROJNAME}



SUPPLIER

<u>SNAME</u>	...
--------------	-----

PROJECT

<u>PROJNAME</u>	...
-----------------	-----

PART

<u>PARTNO</u>	...
---------------	-----

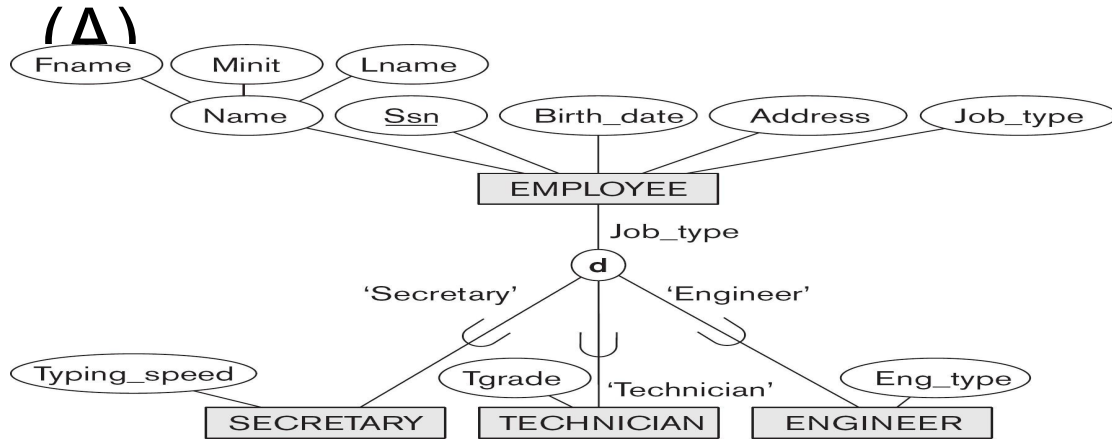
SUPPLY

<u>SNAME</u>	<u>PROJNAME</u>	<u>PARTNO</u>	QUANTITY
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Step 8: Specialization/Generalization

- A. Multiple relations – subclass and superclass
 - Usually works (assumes unique id at parent)
- B. Multiple relations – subclass only
 - Should only be used for disjoint
- C. Single relation with one type attribute
 - Only for disjoint, can result in many NULLs
- D. Single relation with multiple type attributes
 - Better for overlapping, could be disjoint

Specialization/Generalization



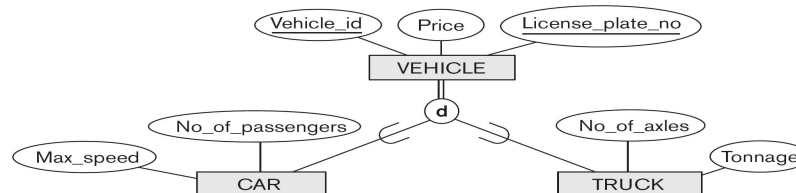
(a) EMPLOYEE



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Specialization/Generalization

(P')



CAR

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

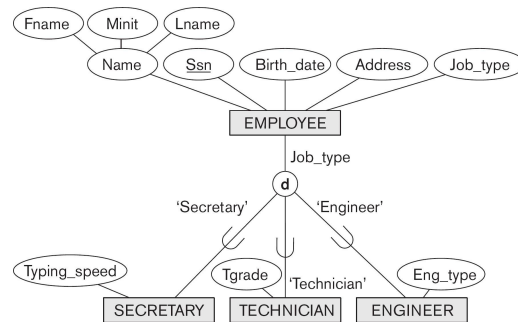
<u>Vehicle_id</u>	License_plate_no	Price	No_of_axles	Tonnage
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Specialization/Generalization (C)

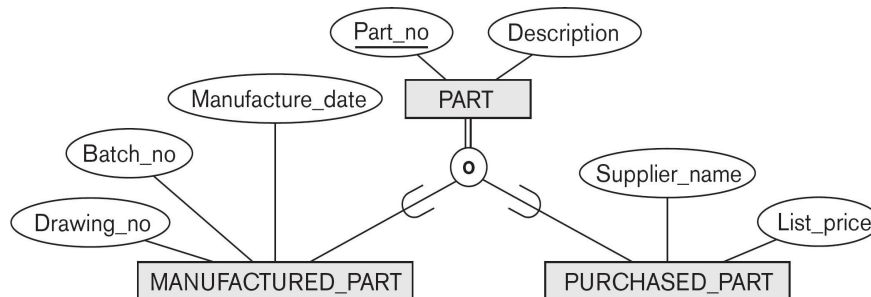
EMPLOYEE

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



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Specialization/Generalization (D)



(d) PART

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