

ER-to-Relational Mapping

Lecture 11

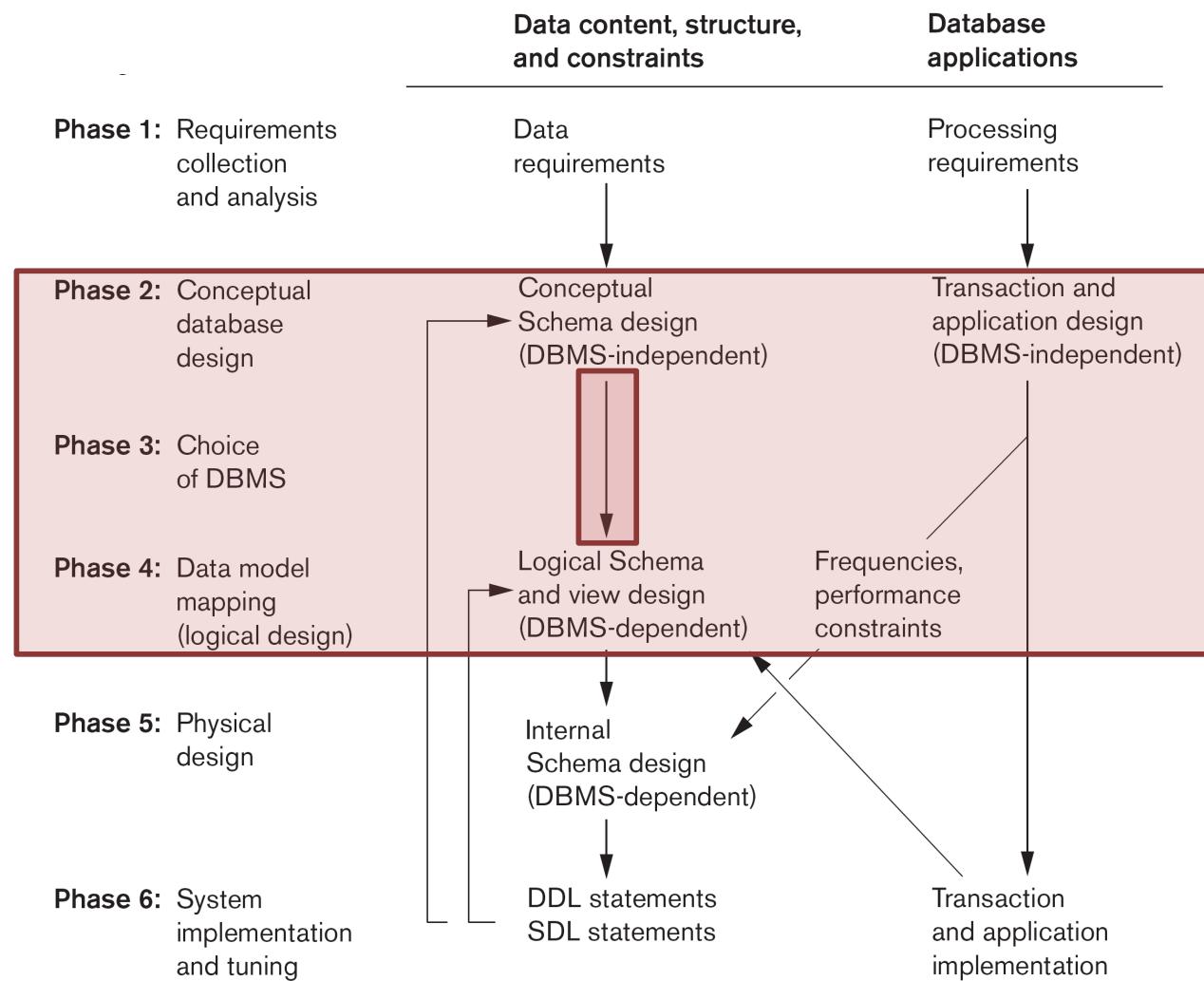


Outline

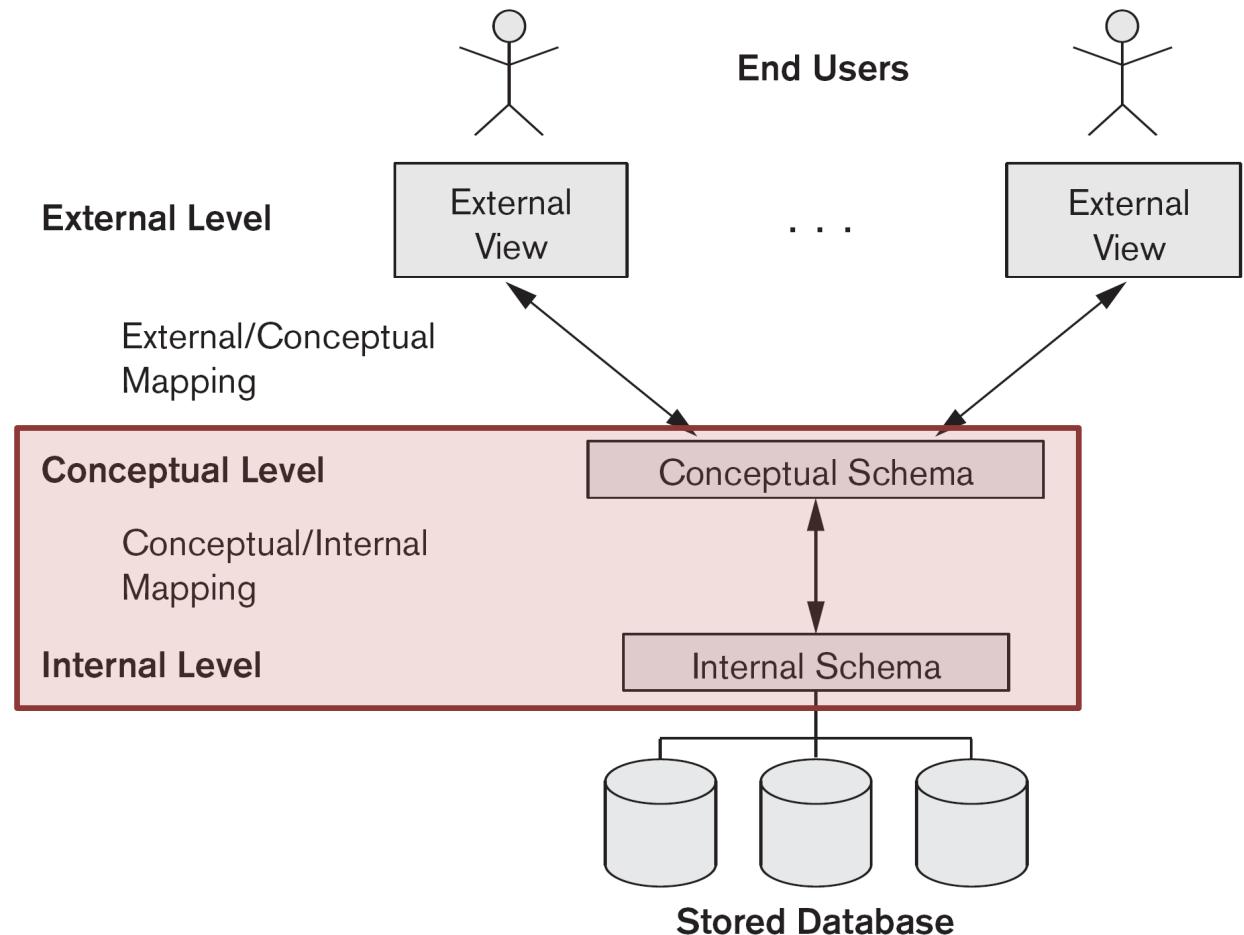
1. Context
2. The Algorithm



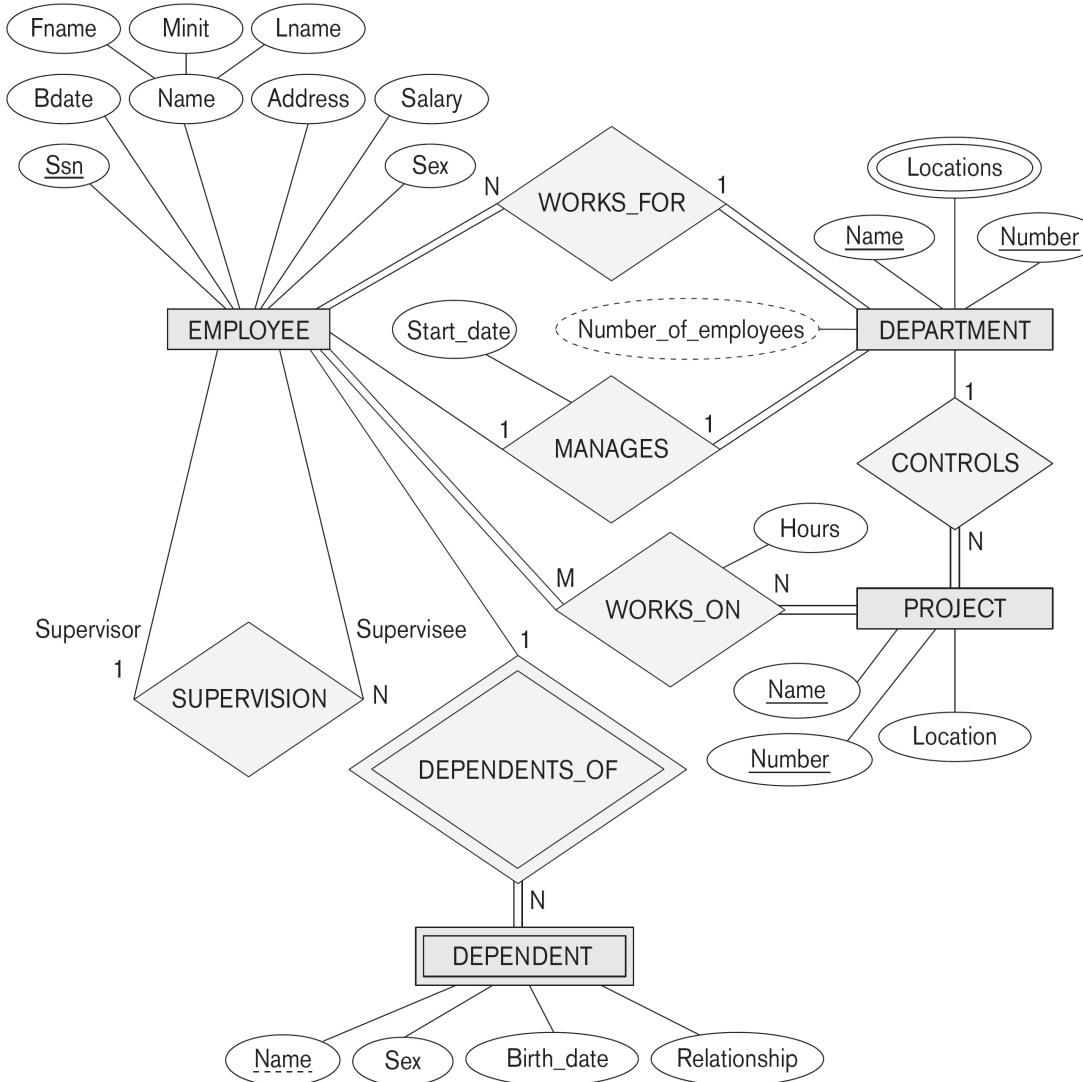
Database Design and Implementation Process



Data Models



Example ERD



Resulting Relational Schema

EMPLOYEE

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

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

<u>Dnumber</u>	<u>Dlocation</u>
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PROJECT

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

Essn	<u>Pno</u>	Hours
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DEPENDENT

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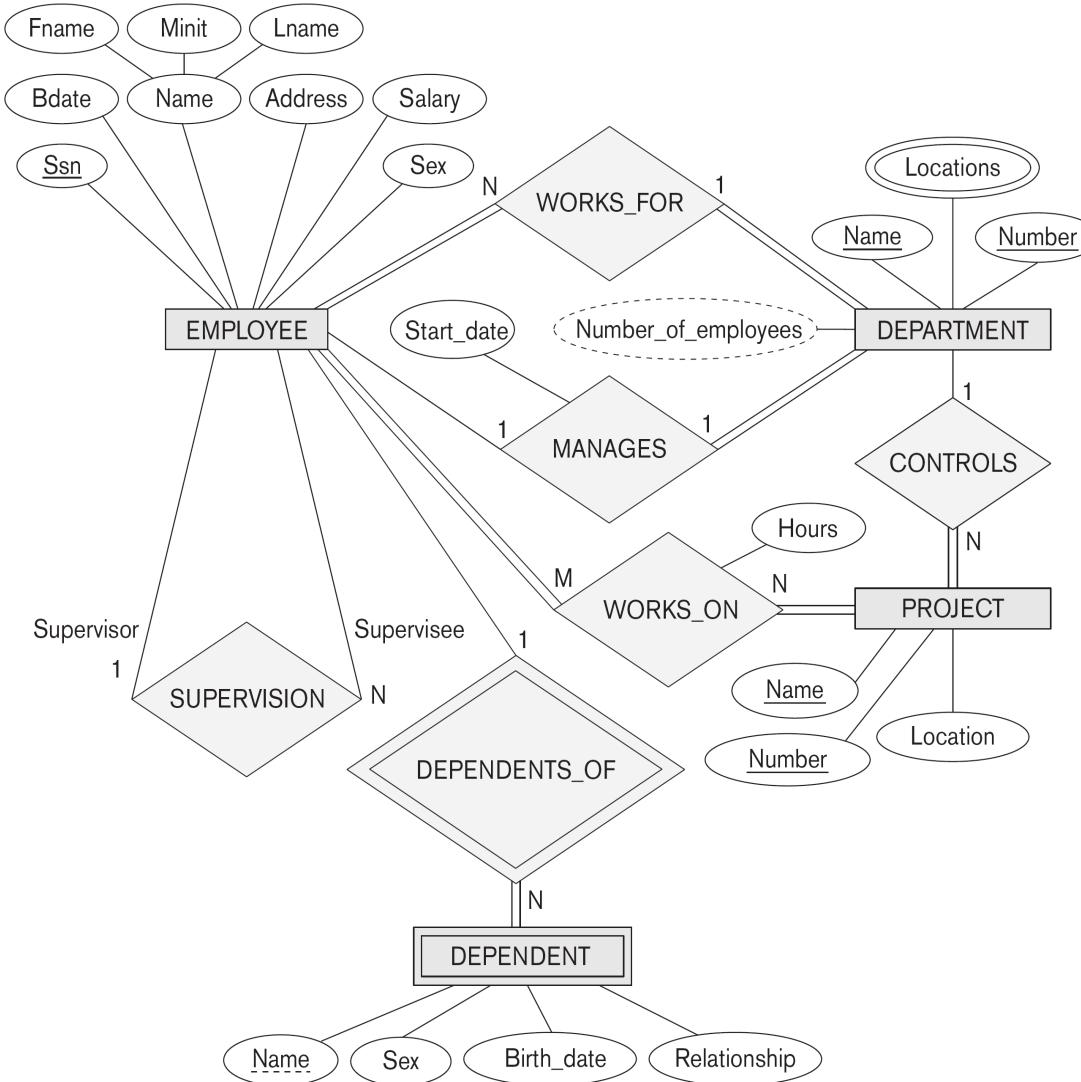


Step 1: Regular Entity Types

- i. For each 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)



Example ERD



Step 1 Result

EMPLOYEE

Fname	Minit	Lname	Ssn	Bdate	Address	Sex	Salary
-------	-------	-------	-----	-------	---------	-----	--------

DEPARTMENT

Dname	<u>Dnumber</u>
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PROJECT

Pname	<u>Pnumber</u>	Plocation
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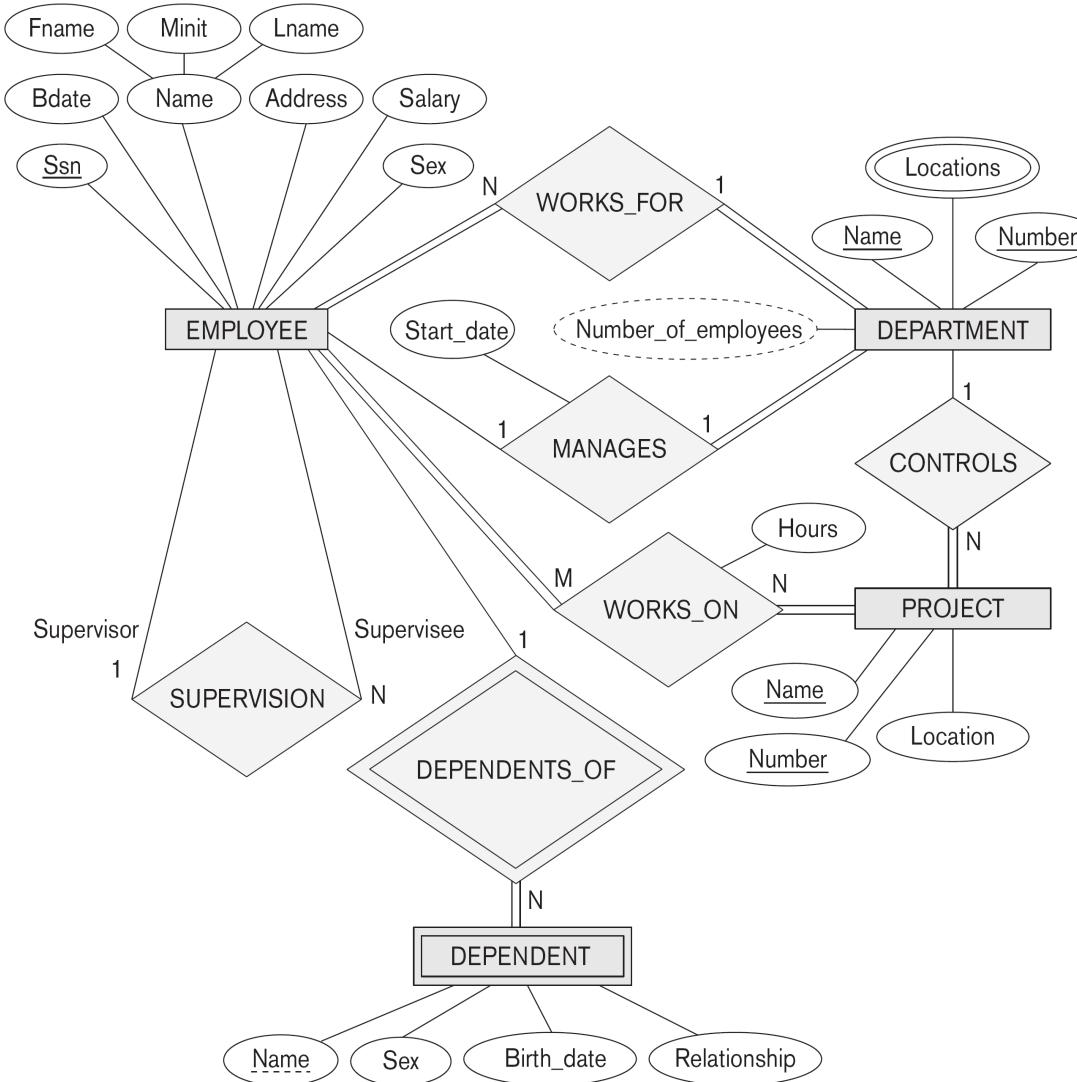


Step 2: Weak Entity Types

- i. For each 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



Example ERD



Step 2 Result

EMPLOYEE

Fname	Minit	Lname	Ssn	Bdate	Address	Sex	Salary
-------	-------	-------	-----	-------	---------	-----	--------

DEPARTMENT

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

PROJECT

Pname	<u>Pnumber</u>	Plocation
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DEPENDENT

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



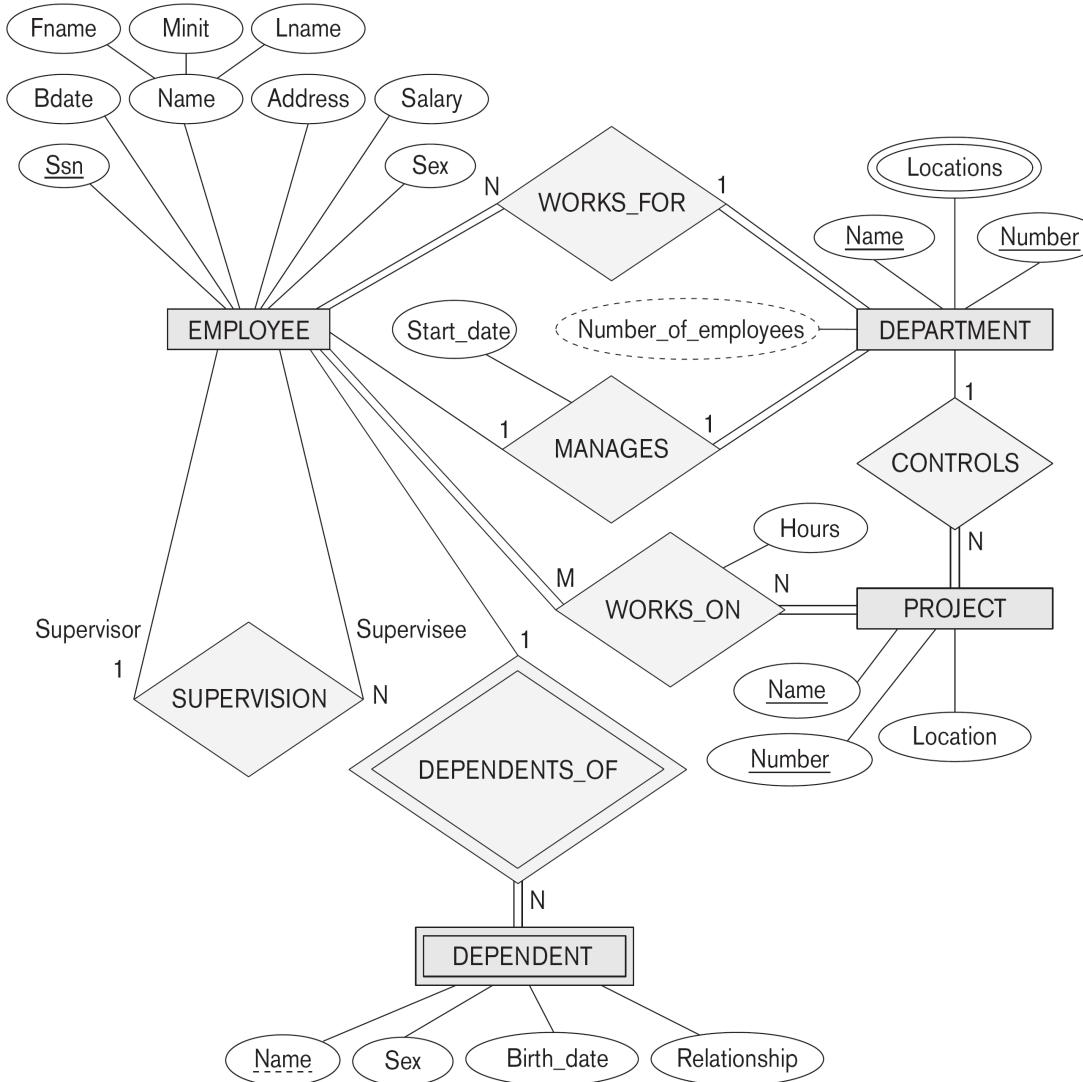
Step 3: Mapping Binary 1-to-1

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



Example ERD



Step 2 Result

EMPLOYEE

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

DEPARTMENT

Dname	<u>Dnumber</u>



Step 3 Result

EMPLOYEE

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

Dname	<u>Dnumber</u>	Mgr_ssn	Mgr_start_date
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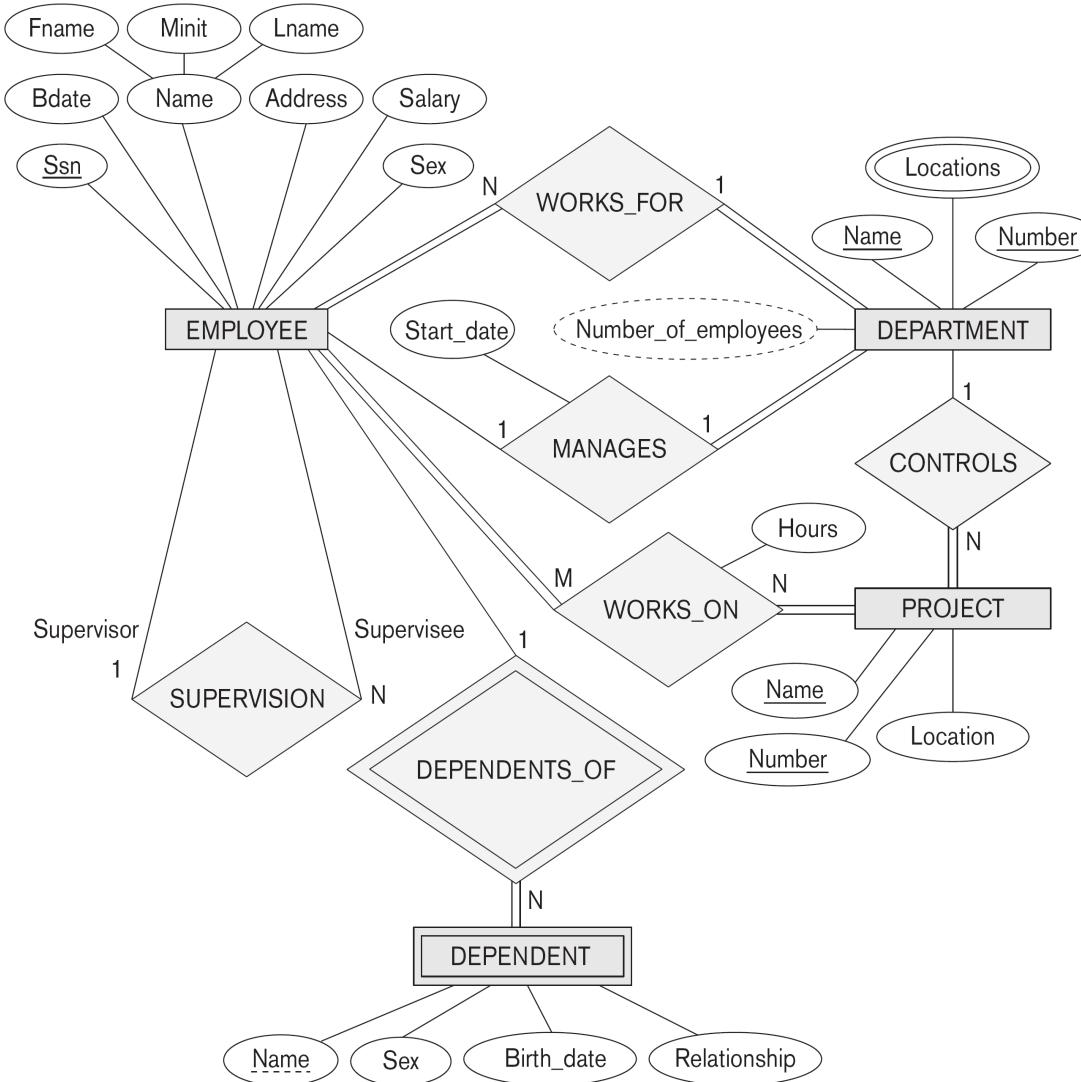
Step 4: Binary 1-to-N

- 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



Example ERD



Step 4 Result

EMPLOYEE

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

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

PROJECT

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

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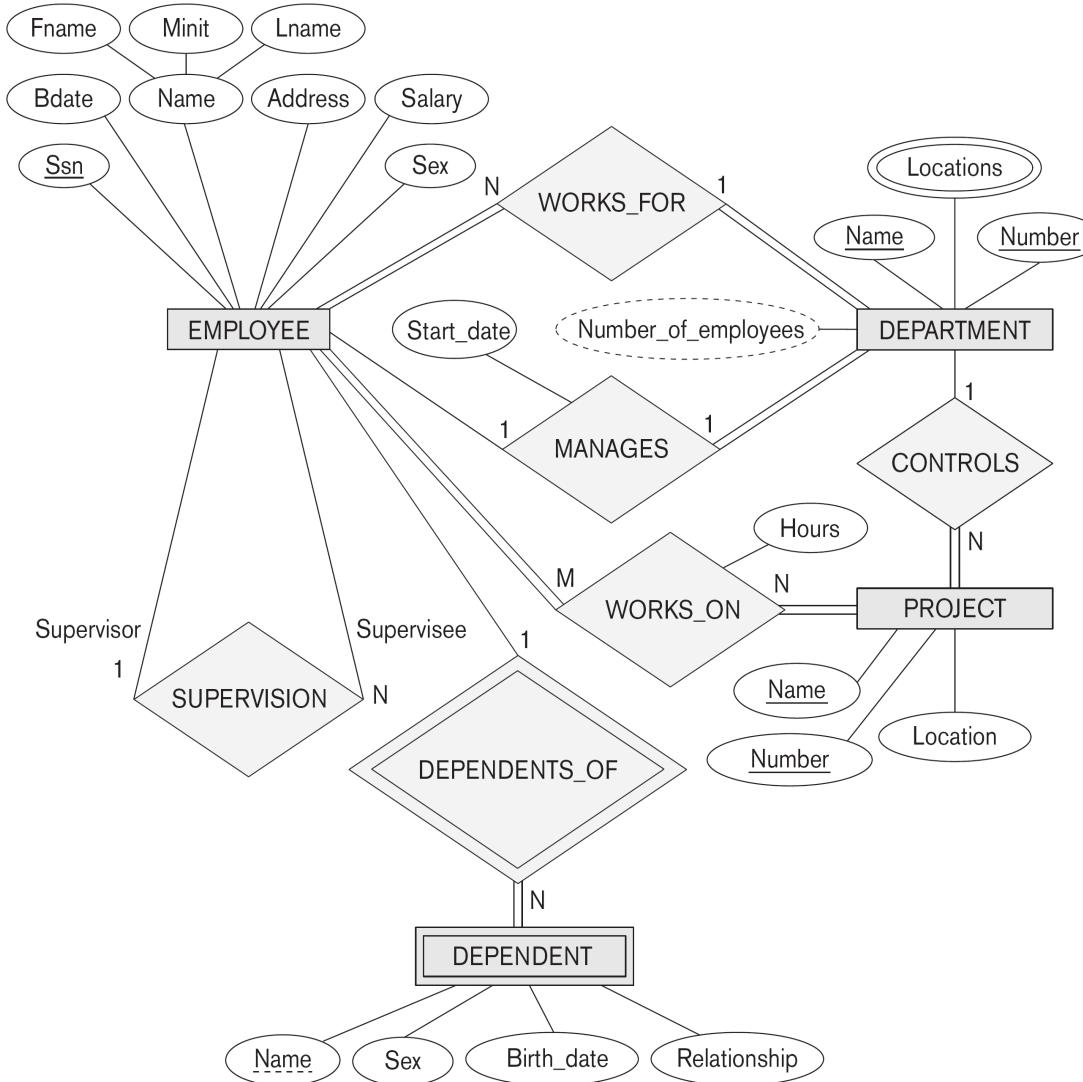


Step 5: Binary M-to-N

- 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



Example ERD



Step 5 Result

EMPLOYEE

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

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

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

Essn	<u>Pno</u>	Hours
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DEPENDENT

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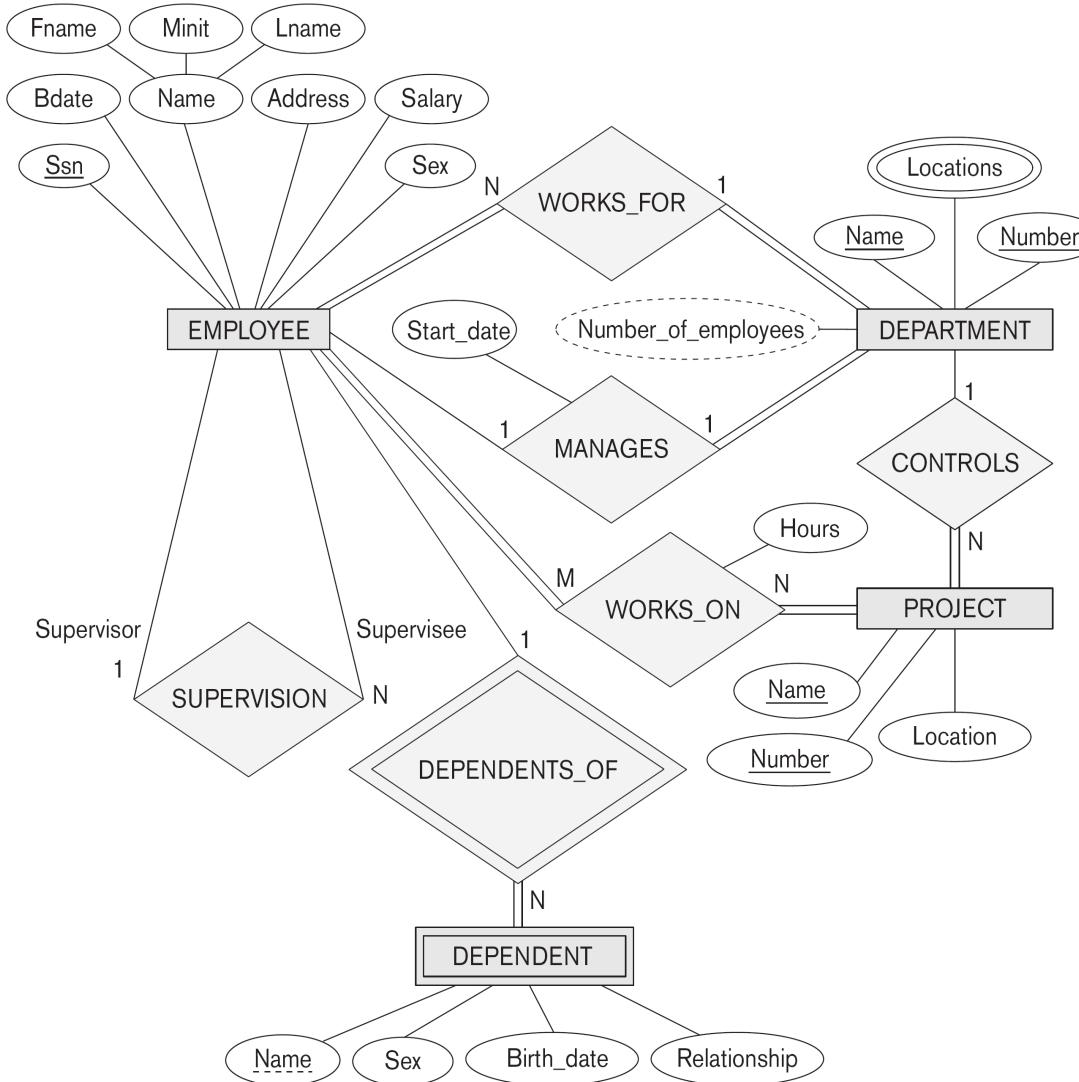


Step 6: Multivalued Attributes

- 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



Example ERD



Step 6 Result

EMPLOYEE

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

DEPARTMENT

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

<u>Dnumber</u>	<u>Dlocation</u>
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PROJECT

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

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

DEPENDENT

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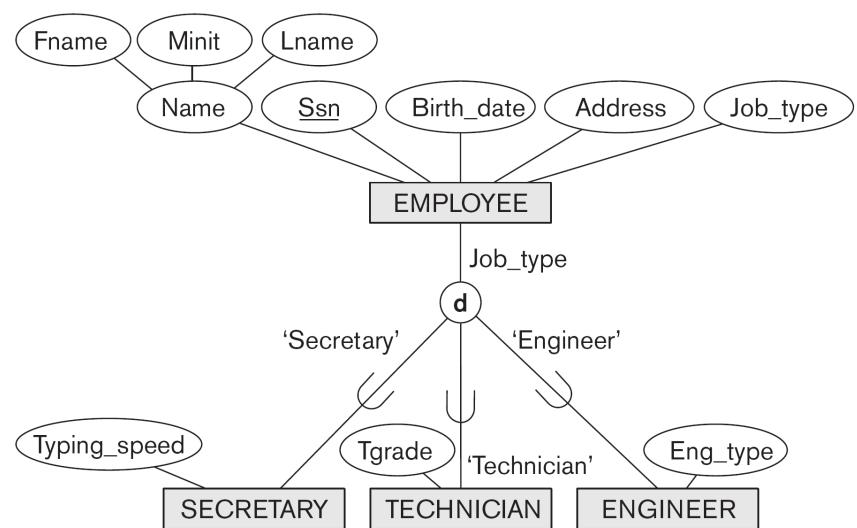
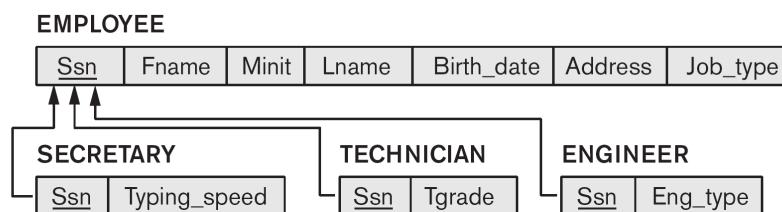


Step 7: Specialization/Generalization

- 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



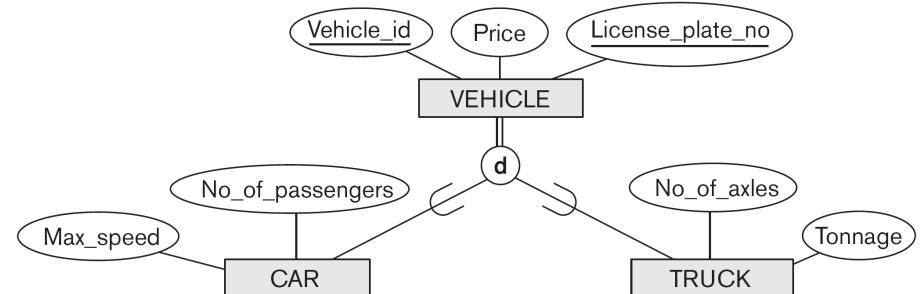
Specialization/Generalization (A)



Specialization/Generalization (B)

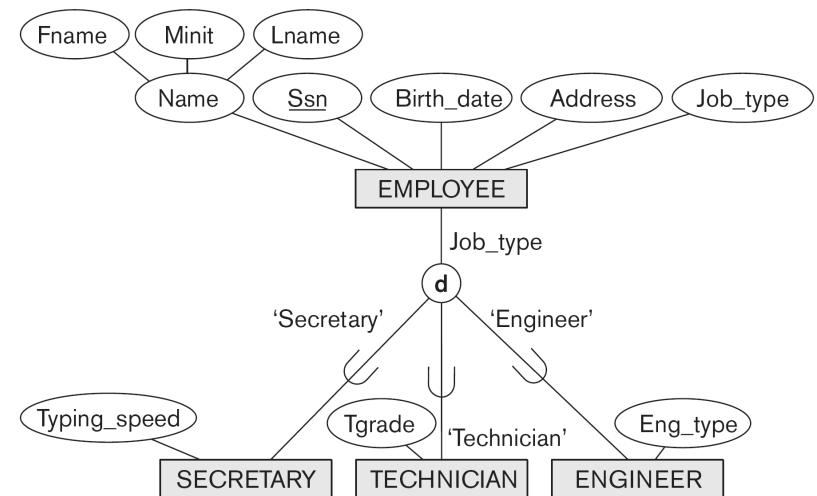
CAR				
Vehicle_id	License_plate_no	Price	Max_speed	No_of_passengers

TRUCK				
Vehicle_id	License_plate_no	Price	No_of_axles	Tonnage



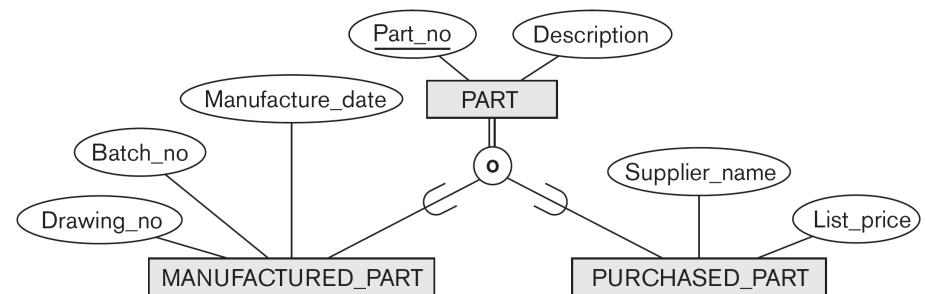
Specialization/Generalization (C)

EMPLOYEE									
Ssn	Fname	Minit	Lname	Birth_date	Address	Job_type	Typing_speed	Tgrade	Eng_type



Specialization/Generalization (D)

PART
Part_no Description Mflag Drawing_no Manufacture_date Batch_no Pflag Supplier_name List_price



Summary

- Mapping from ERDs to relations is an algorithmic process
- Some choice points involve comparing time-space tradeoffs (more in physical design)

