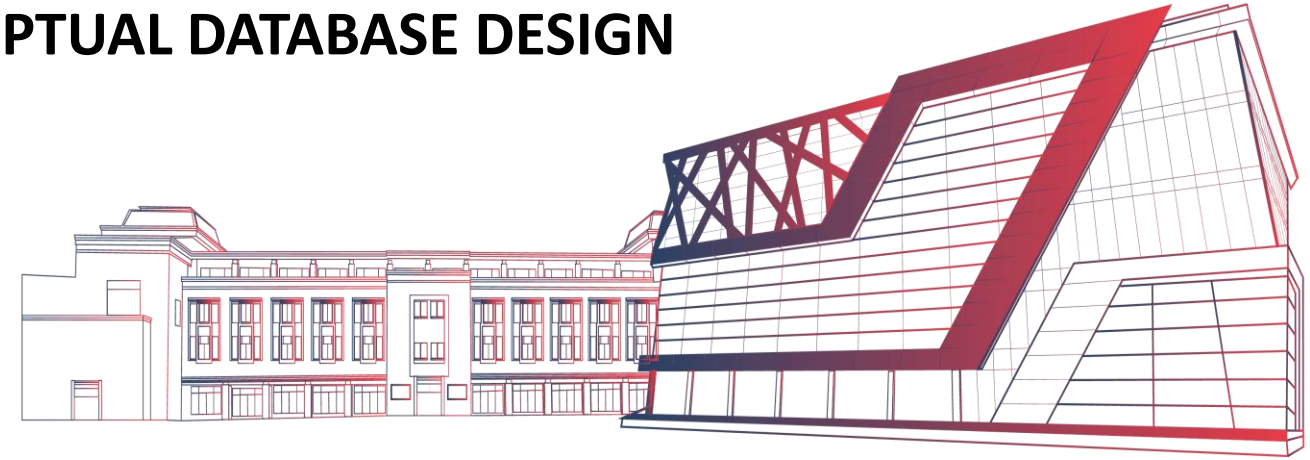
THE NORTHCAP UNIVERSITY

UNIT II

CONCEPTUAL DATABASE DESIGN



30 YEARS OF EXCELLENCE

NAAC Accredited

Lecture 10

THE NORTHCAP UNIVERSITY

Mapping a Conceptual Design into a Logical Design

Steps to Convert ER → Relational

- **ER-to-Relational Mapping Algorithm**

Step 1: Mapping of Regular Entity Types

Step 2: Mapping of Weak Entity Types

Step 3: Mapping of Binary 1:1 Relation Types

Step 4: Mapping of Binary 1:N Relationship Types

Step 5: Mapping of Binary M:N Relationship Types

Step 6: Mapping of Multivalued attributes

Step 7: Mapping of N-ary Relationship Types

- **Mapping EER Model Constructs to Relations**

Step 8: Options for Mapping Specialization or Generalization

Step 9: Mapping of Union Types (Categories)

Example COMPANY Database

THE NORTHCAP UNIVERSITY

- The company is organized into DEPARTMENTs. Each department has a name, number and an employee who *manages* the department. We keep track of the start date of the department manager.
- Each department *controls* a number of PROJECTs. Each project has a name, number and is located at a single location.

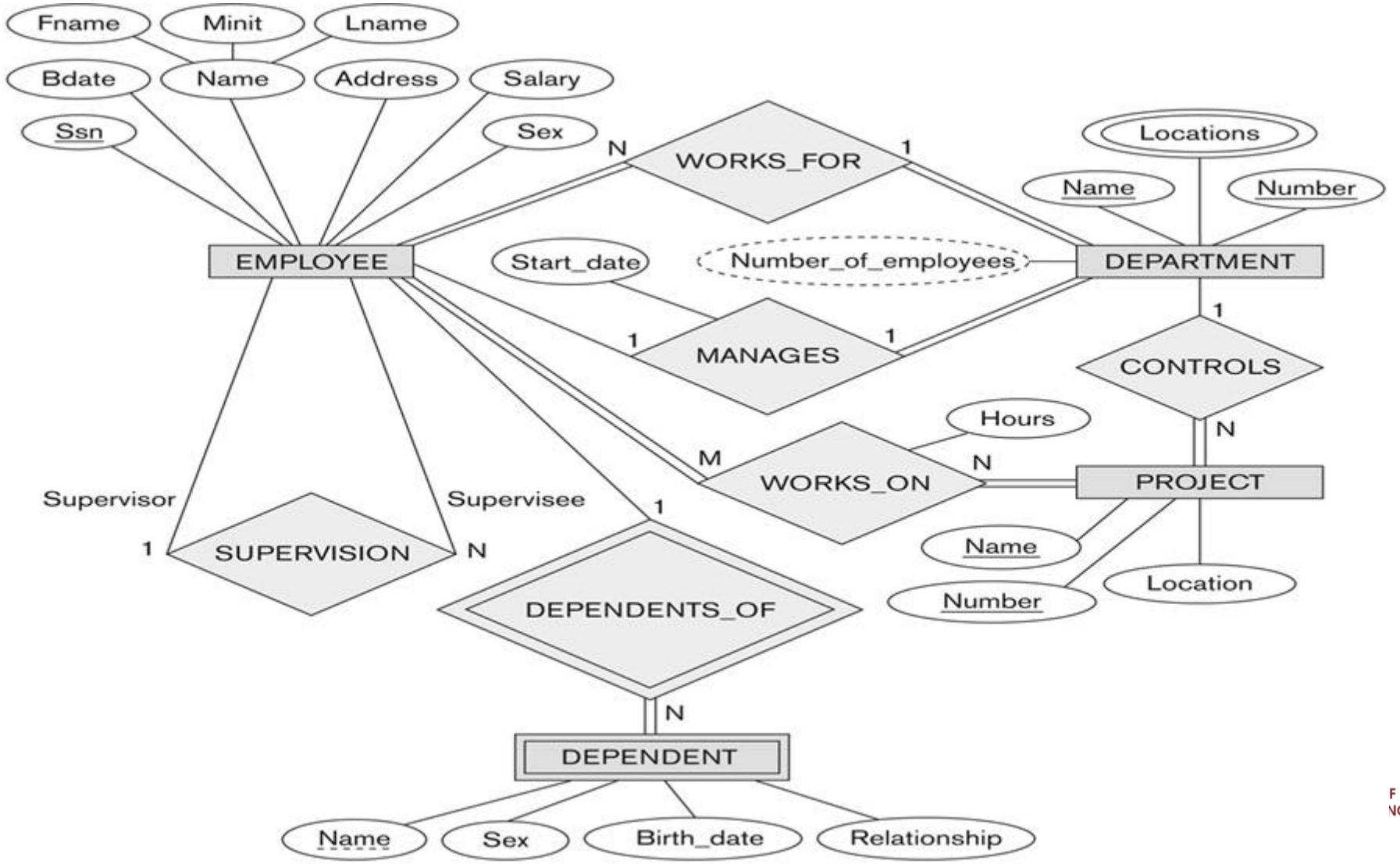
NAAC Accredited

Example COMPANY Database (Cont.)

- We store each EMPLOYEE's social security number, address, salary, sex, and birthdate. Each employee *works for* one department but may *work on* several projects. We keep track of the number of hours per week that an employee currently works on each project. We also keep track of the *direct supervisor* of each employee.

- Each employee may *have* a number of DEPENDENTs. For each dependent, we keep track of their name, sex, birthdate, and relationship to employee.

ER Diagram – Company Database



ER-to-Relational Mapping Algorithm

- **Step 1: Mapping of Regular Entity Types.**

For each **regular (strong) entity type E** in the ER schema, create **a relation R** that includes all the simple attributes of E. **Choose one of the key attributes of E as the 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.

Example: Create the relations EMPLOYEE, DEPARTMENT, and PROJECT in the relational schema corresponding to the regular entities in the ER diagram. SSN, DNUMBER, and PNUMBER are the primary keys for the relations EMPLOYEE, DEPARTMENT, and PROJECT.

Output

Result after Step1: Mapping of Regular Entity Types.

EMPLOYEE

Fname	Minit	Lname	Ssn	Bdate	Address	Sex	Salary

DEPARTMENT

Dname	Dnumber

PROJECT

Pname	Pnumber	Plocation

ER-to-Relational Mapping Algorithm (Cont.)

THE NORTHCAP UNIVERSITY

- **Step 2: Mapping of Weak Entity Types**

For each **weak entity type W** in the ER schema with owner entity type E, **create a relation R and include all simple attributes** (or 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).

The **primary key of R** is the *combination of* the primary key(s) of the owner(s) and the partial key of the weak entity type W, if any.

Example – Mapping Weak Entities

Create the relation DEPENDENT to correspond to the weak entity type DEPENDENT. Include the primary key SSN of the EMPLOYEE relation as a foreign key attribute of DEPENDENT (renamed to ESSN).

The primary key of the DEPENDENT relation is the combination

{ESSN, DEPENDENT_NAME} because DEPENDENT_NAME is the partial key of DEPENDENT

DEPENDENT

Essn	Dependent_name	Sex	Bdate	Relationship

- **Step 3: Mapping of Binary 1:1 Relationship Types**

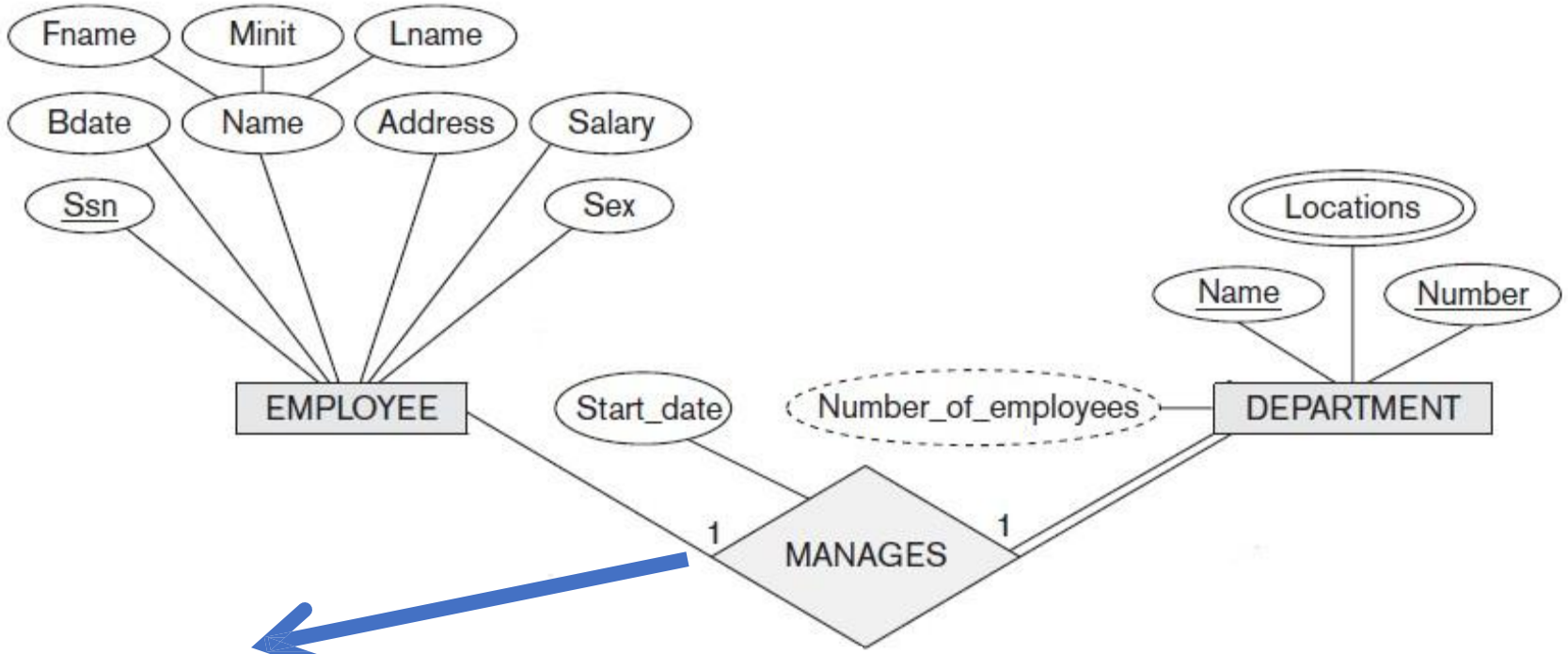
For each binary 1:1 relationship type R in the ER schema, identify the relations S and T that correspond to the entity types participating in R. There are three possible approaches:

a. **Foreign Key Approach:** Choose one of the relations – say S, and include a 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.

Example - Mapping of Binary 1:1 Relationship

Foreign Key Approach

1:1 relation MANAGES is mapped by choosing the participating entity type DEPARTMENT to serve in the role of S, because its participation in the MANAGES relationship type is total.



DEPARTMENT

Dname	Dnumber	Mgr_ssn	Mgr_start_date

b. Merged Relation Option: An alternate mapping of a 1:1 relationship type is possible by **merging the two entity types and the relationship into a single relation**. This may be appropriate when *both participations are total.*

b. Cross-reference or Relationship Relation Option: The third alternative is to set up a third relation R for the purpose of cross-referencing the primary keys of the two relations S and T representing the entity types. Required for binary M:N relationships

THE NORTHCAP UNIVERSITY

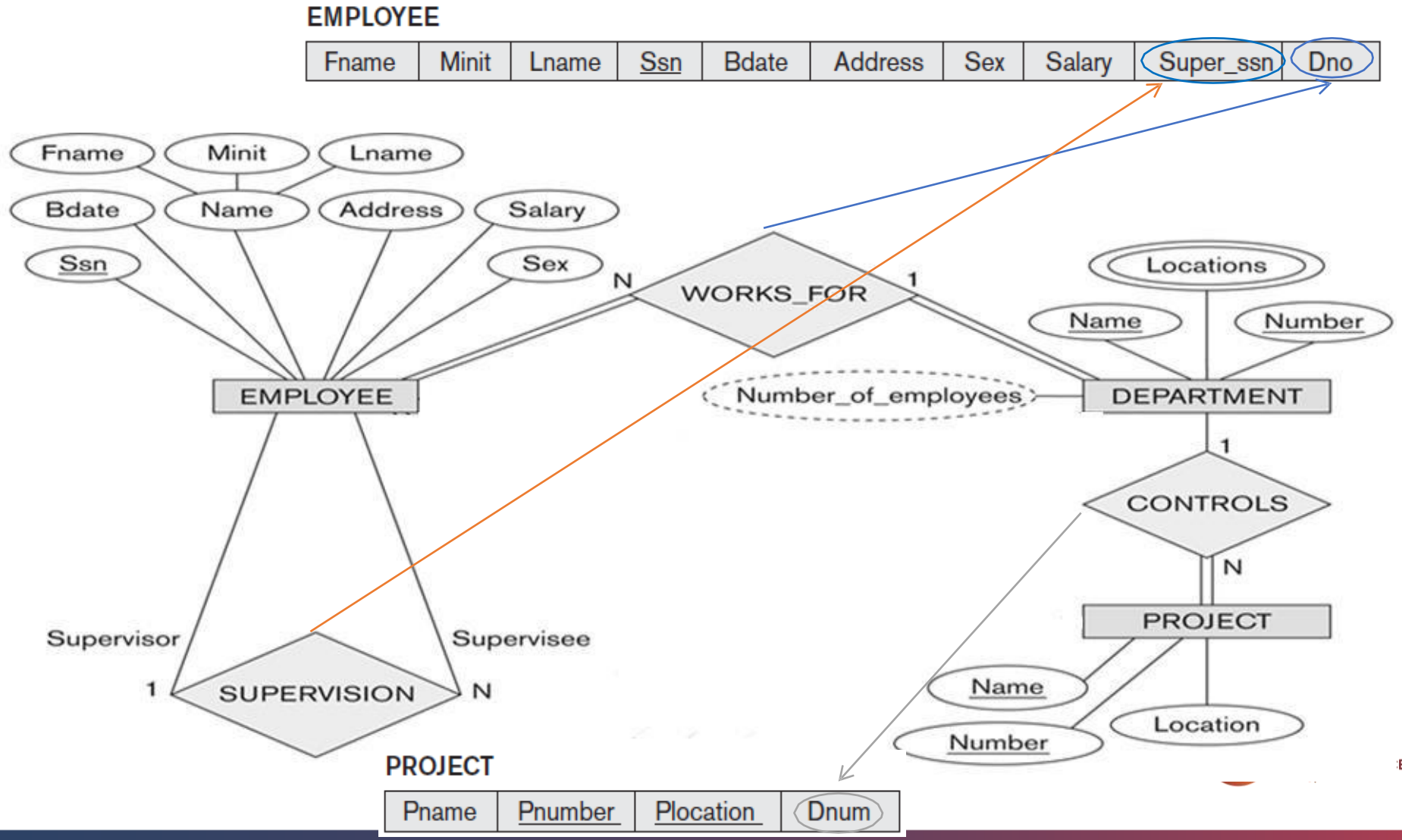
- **Step 4: Mapping of Binary 1:N Relationship Types.**

For each regular **binary 1:N relationship** type R, identify the relation S that represent the participating entity type at the N-side of the relationship type.

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

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

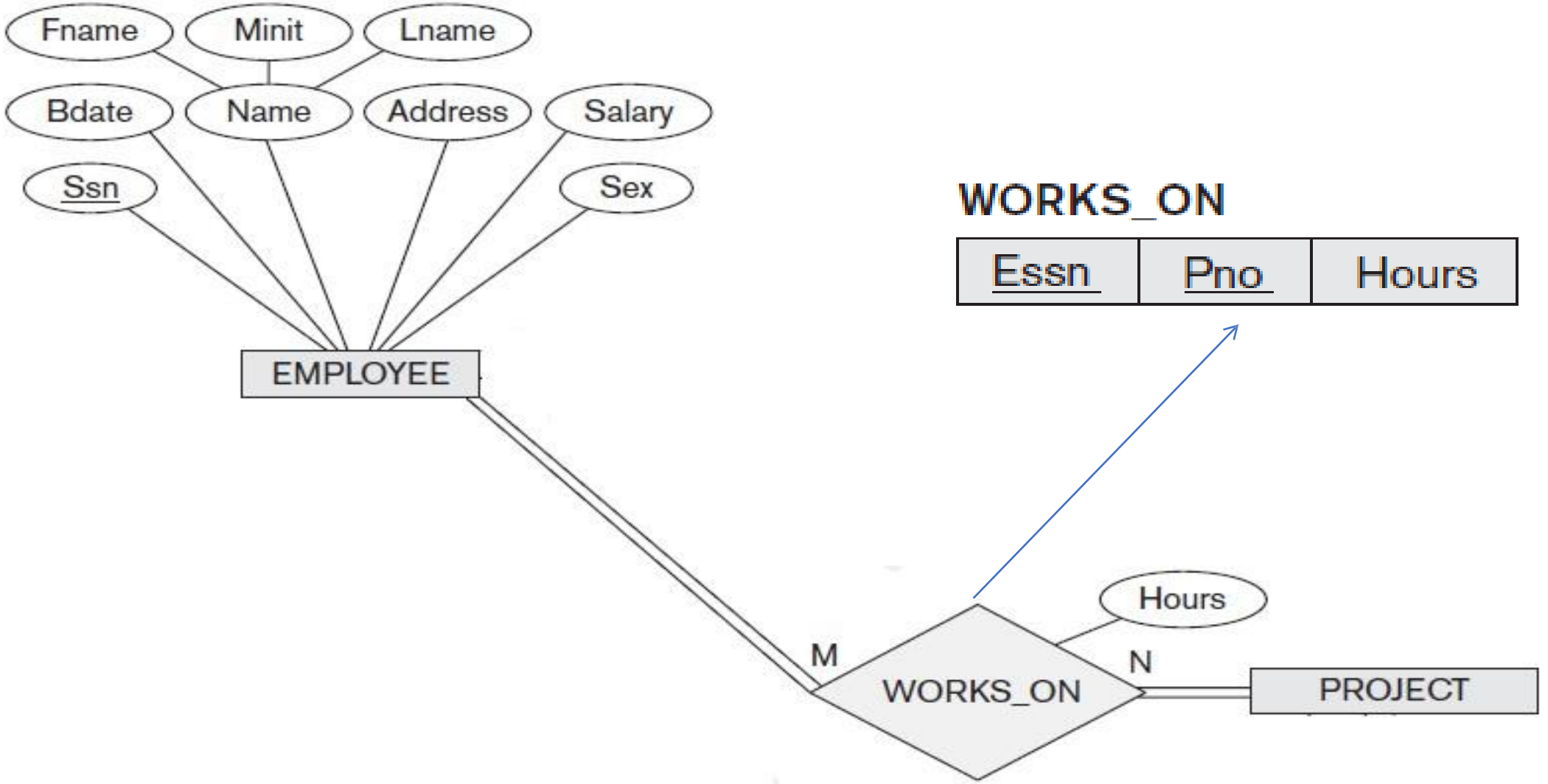
Example - Mapping of Binary 1:N Relationship – WORKS_FOR, CONTROLS, and SUPERVISION.



- **Step 5: Mapping of Binary M:N Relationship Types.**

  - **For each regular 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 (or simple components of composite attributes) as attributes of S.

Example - Mapping of Binary M:N Relationship



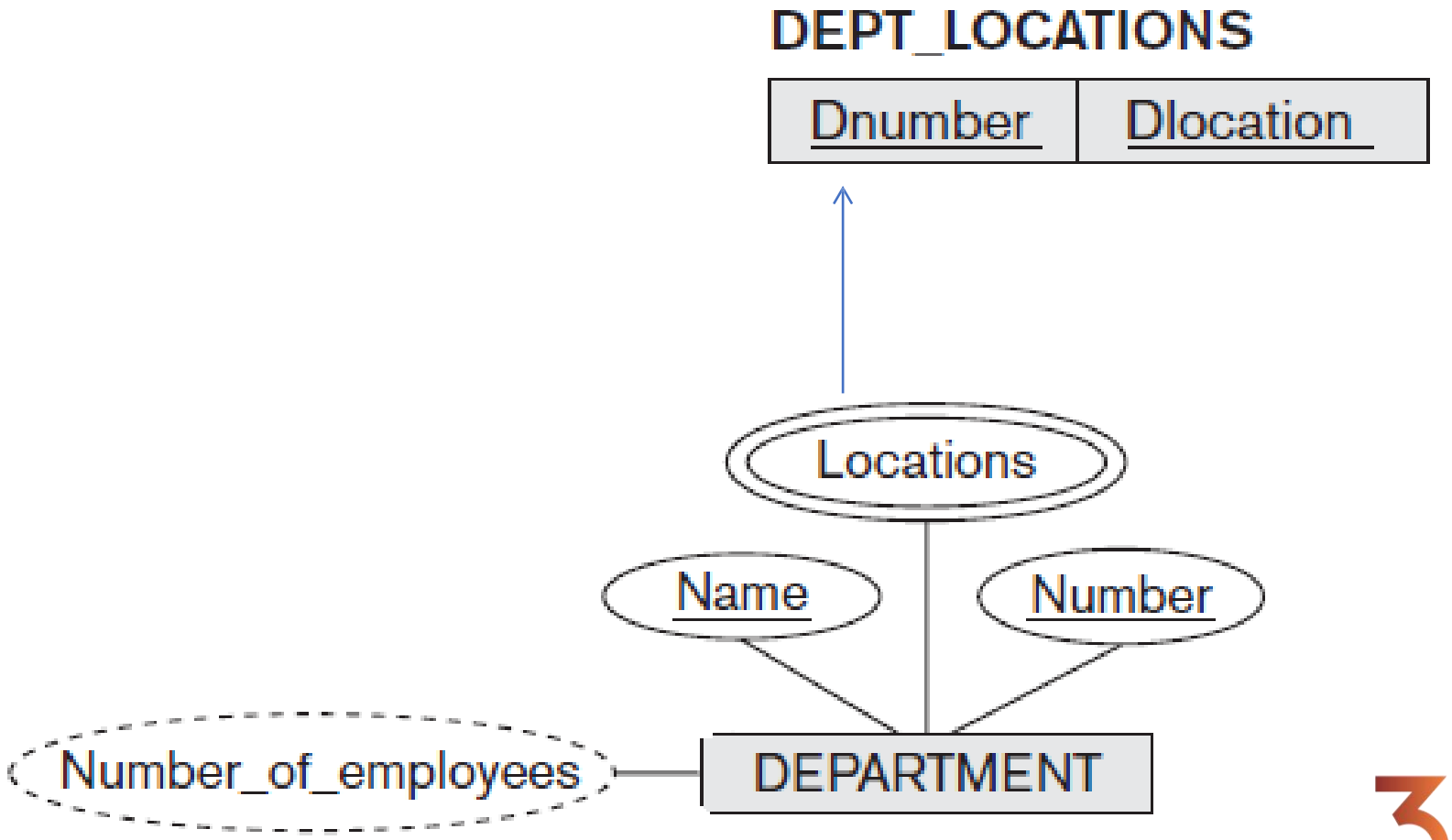
ER-TO-RELATIONAL MAPPING ALGORITHM (CONT.)

- Step 6: Mapping of Multivalued attributes.

  - For each multivalued attribute A, create a new relation R. This relation R will include 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 of relationship type that has A as an attribute.

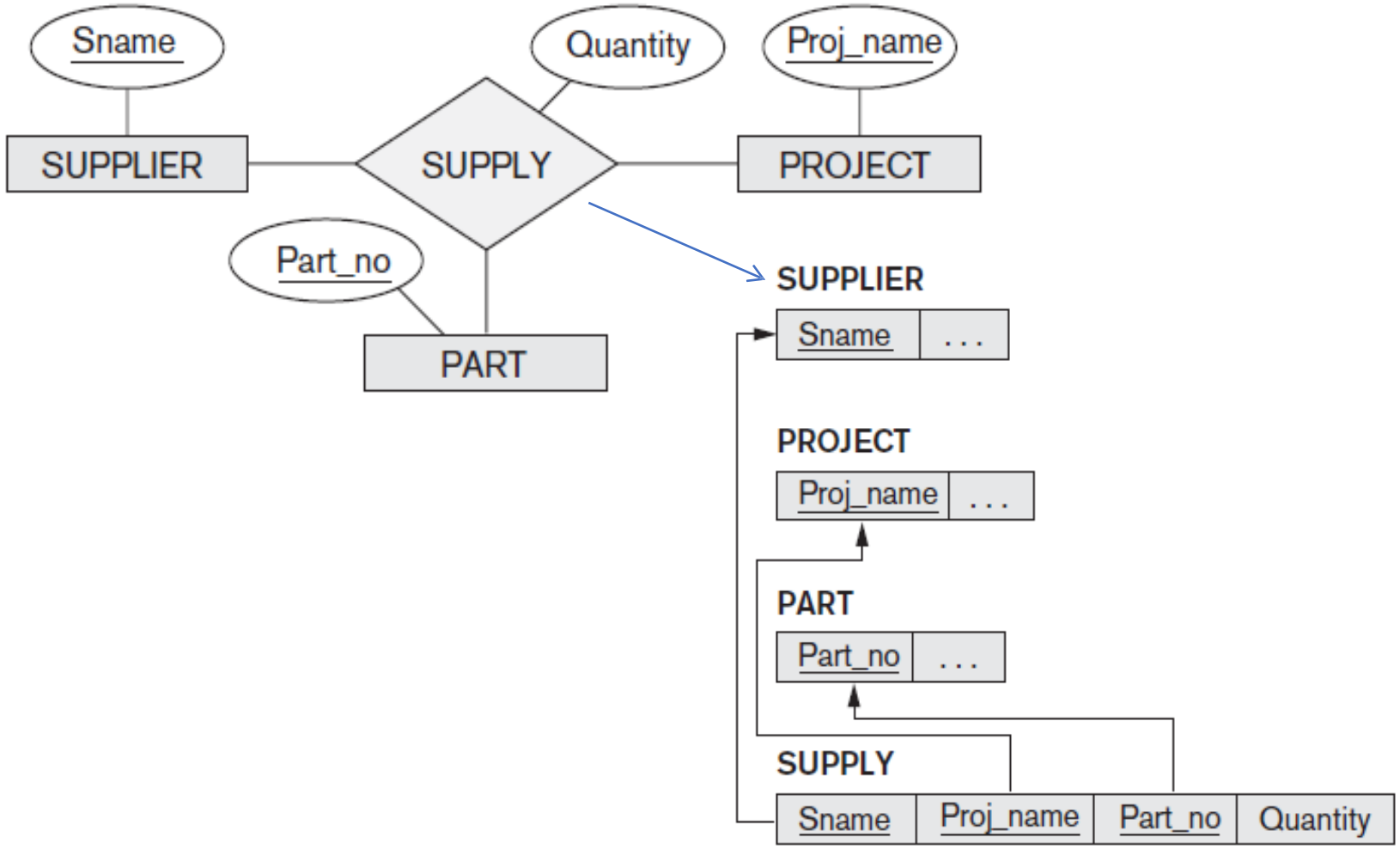
  - The primary key of R is the combination of A and K. If the multivalued attribute is composite, we include its simple components.

EXAMPLE - MAPPING OF MULTIVALUED ATTRIBUTES



- **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.

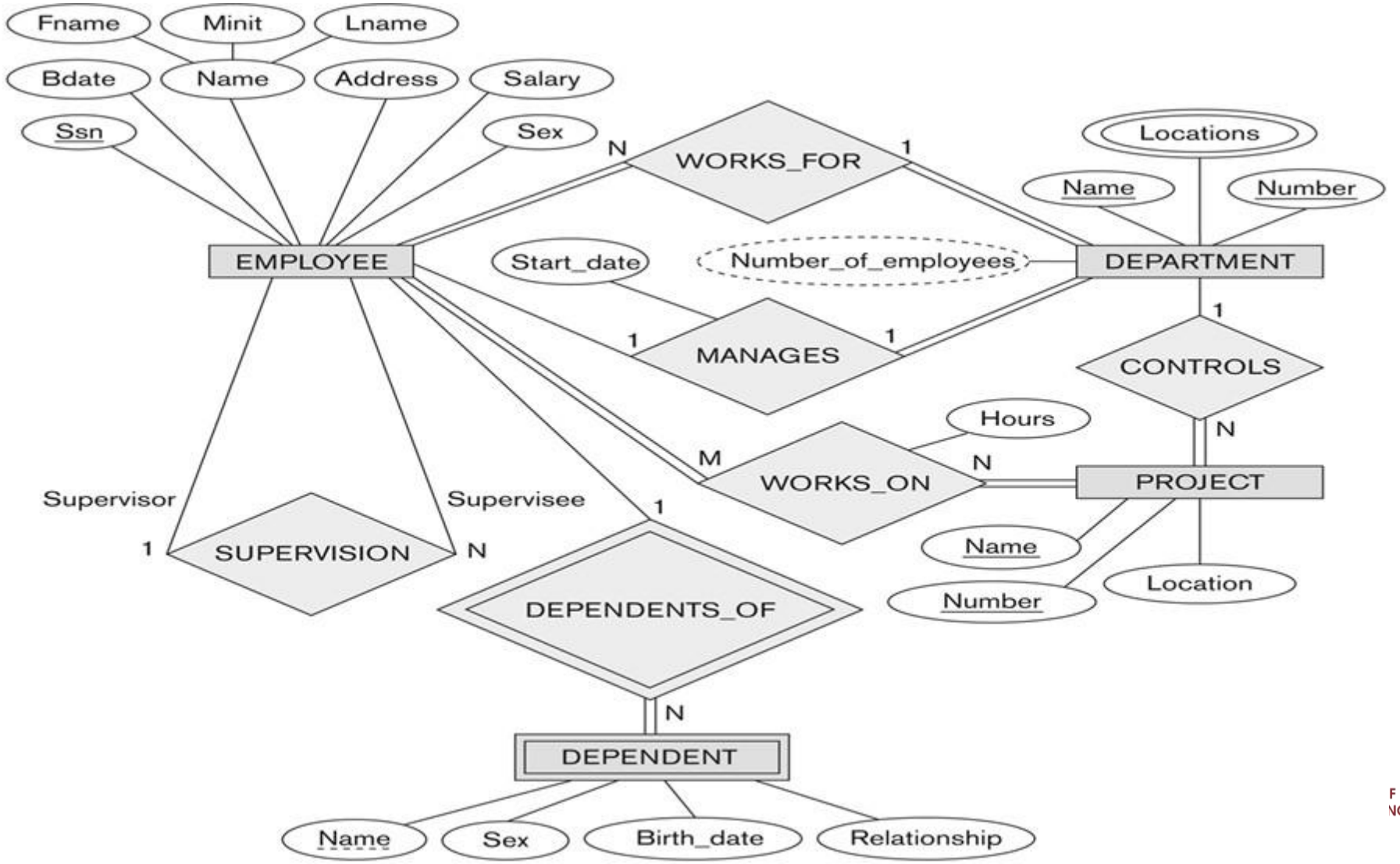
Example - Mapping of N-ary Relationship



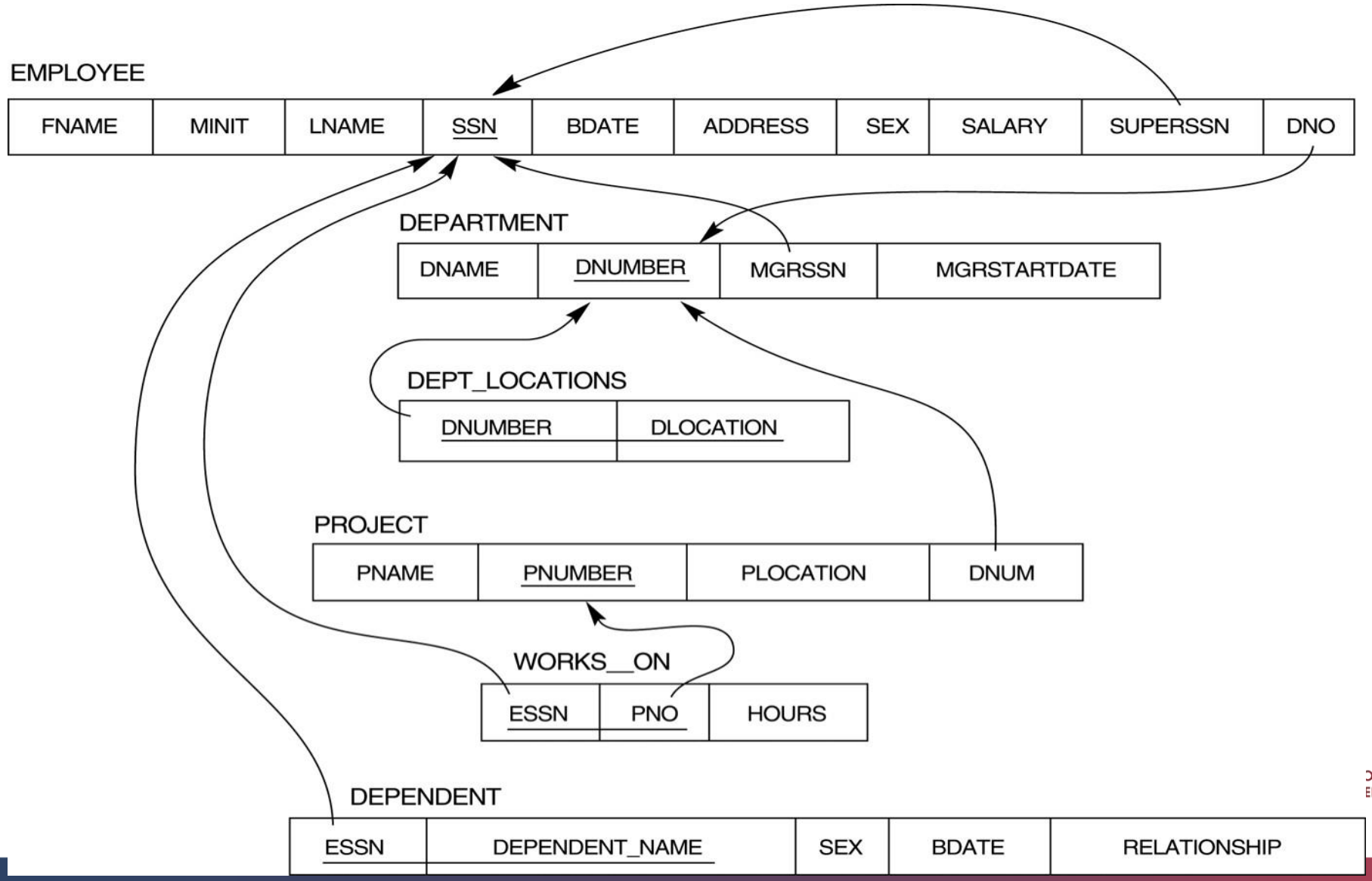
Summary of Mapping ER Model Constructs

ER MODEL	RELATIONAL MODEL
Entity type	*Entity* relation
1:1 or 1:N relationship type	Foreign key (or *relationship* relation)
M:N relationship type	*Relationship* relation and *two* foreign keys
n-ary relationship type	*Relationship* relation and *n* foreign keys
Simple attribute	Attribute
Composite attribute	Set of simple component attributes
Multivalued attribute	Relation and foreign key
Value set	Domain
Key attribute	Primary (or secondary) key

ER Diagram – Company Database



Final Mapping of COMPANY ER Model to Relational Schema



THE NORTHCAP UNIVERSITY

Thanks!!