COMP9311:
DATABASE SYSTEMS

Term 1 2024

Week 2 – ER to Relational Data Model

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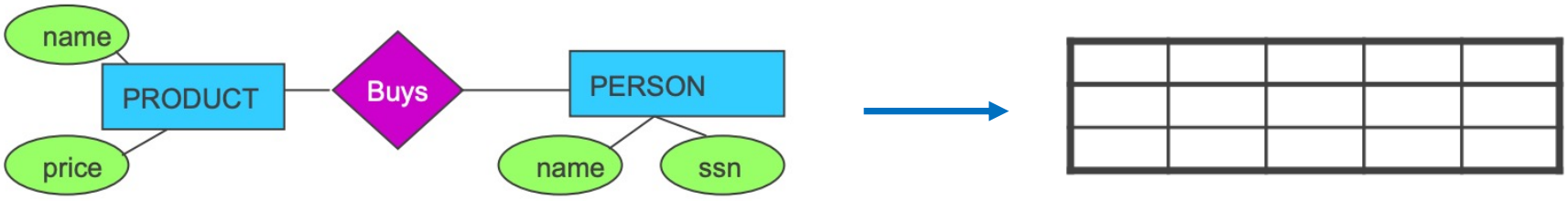
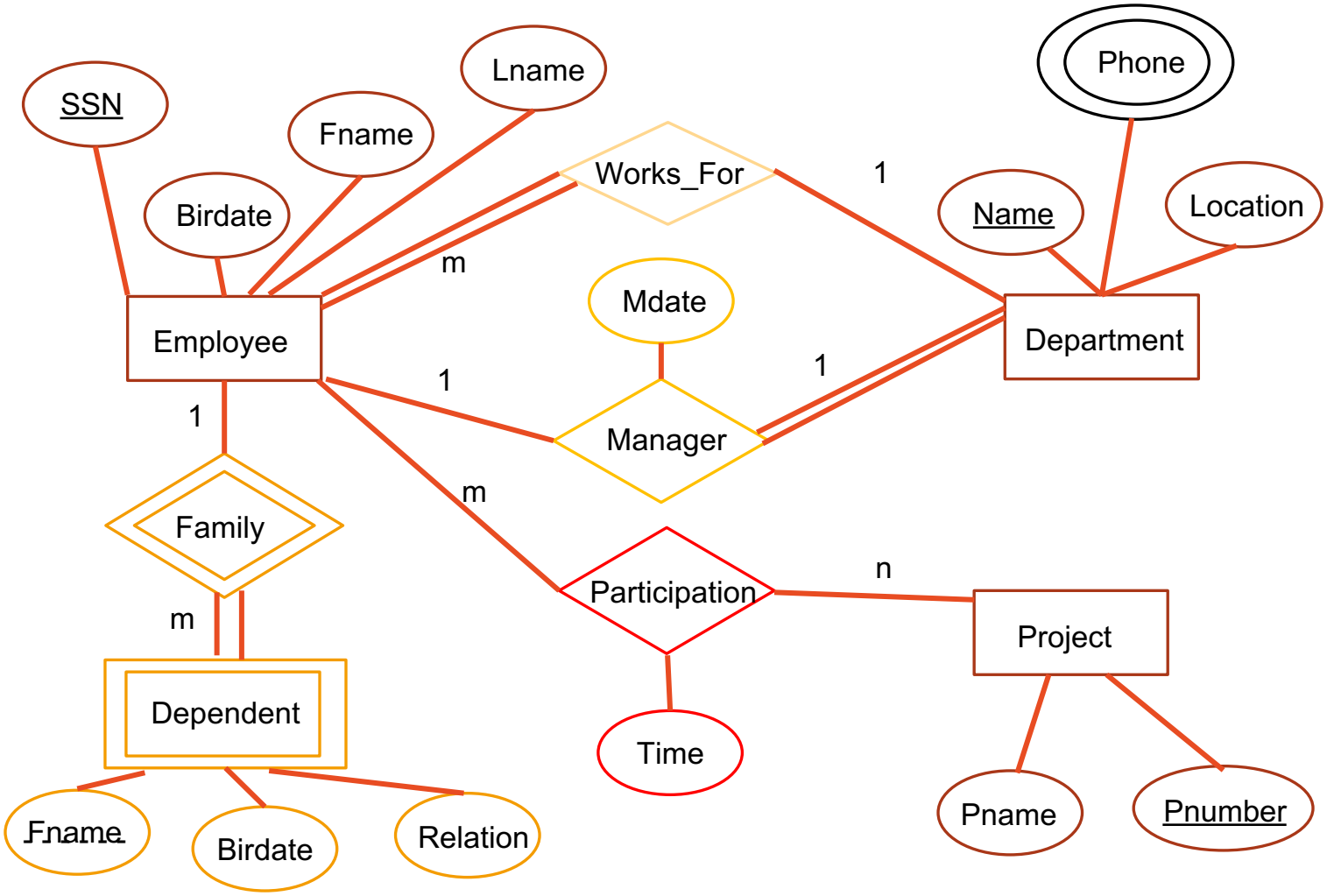
Disclaimer: the course materials are sourced from previous offerings of COMP9311 and COMP3311

ER to Relational Data Model Mapping

- One technique for database design is to first design a conceptual schema using a high-level data model,
- and then map it to a conceptual schema in the DBMS data model for the chosen DBMS.
- Here we look at a way to do this mapping from the ER to the relational data model.
- It involves the following **7 steps**.



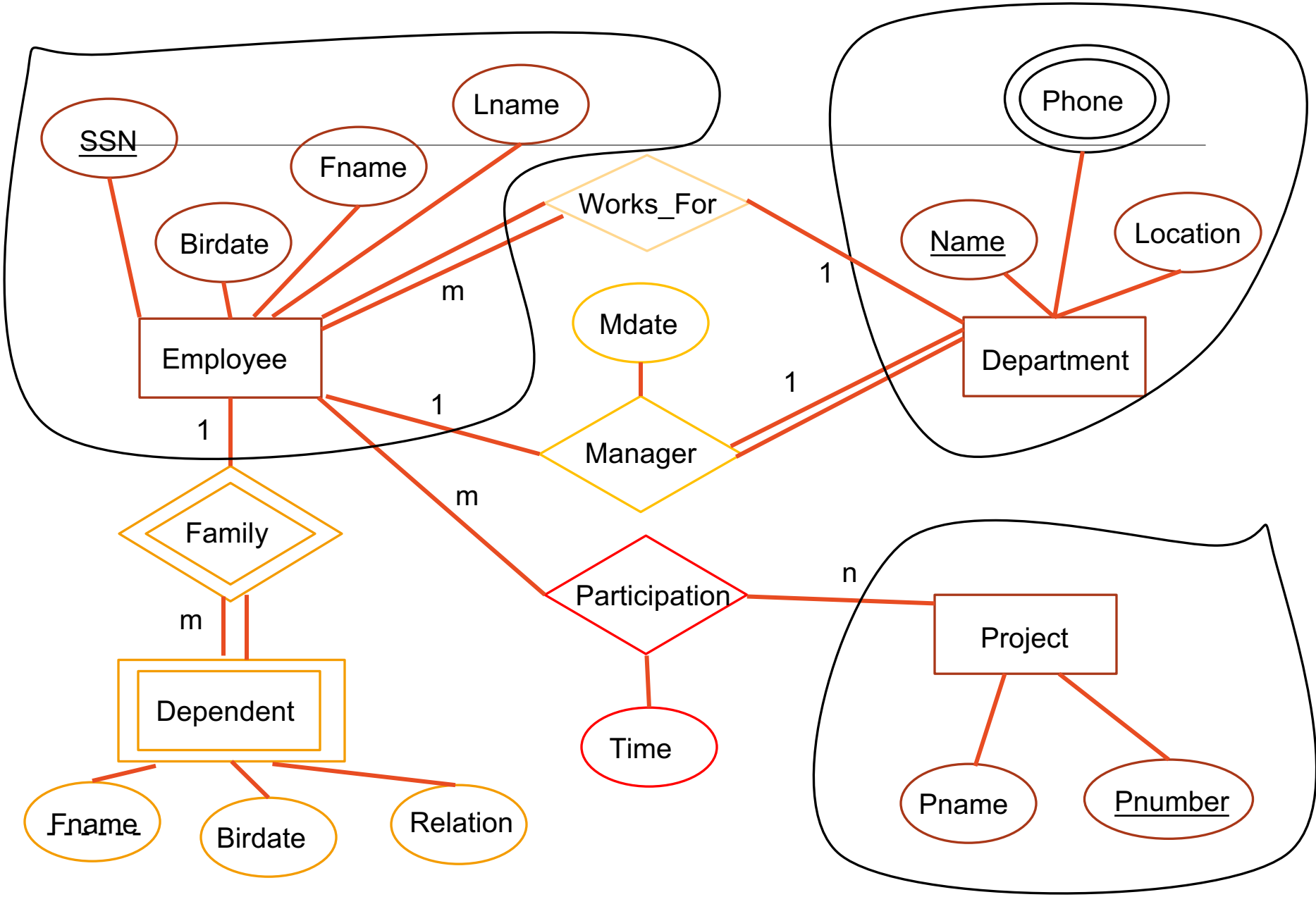
Guiding Example



Mapping Strong Entity Types

Step 1: For each *strong entity* (not weak entity) type E, create a new relation R with

- Attributes : all *simple attributes* (and simple components of composite attributes) of E.
- Key : key of E as the *primary key* for the relation.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Mapping Strong Entity Types

Employee

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Mapping Weak Entity Types

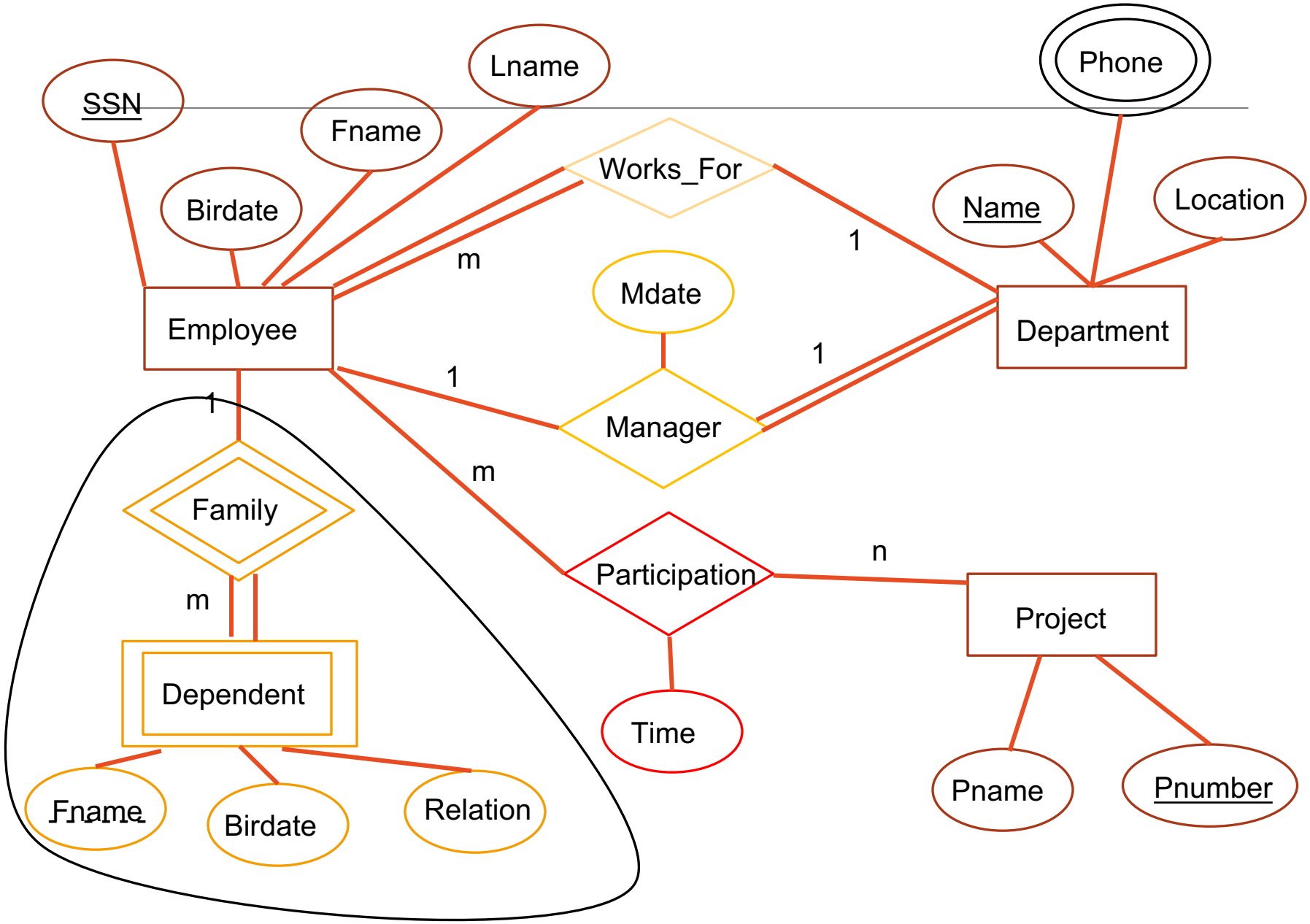
Step 2: For each *weak entity type* W with the owner entity type E, create a new relation R with

Attributes :

- all simple attributes (and simple components of composite attributes) of W,
- and include the primary key attributes of the relation derived from E as the foreign key.

Key of R:

- foreign key to E and partial key of W.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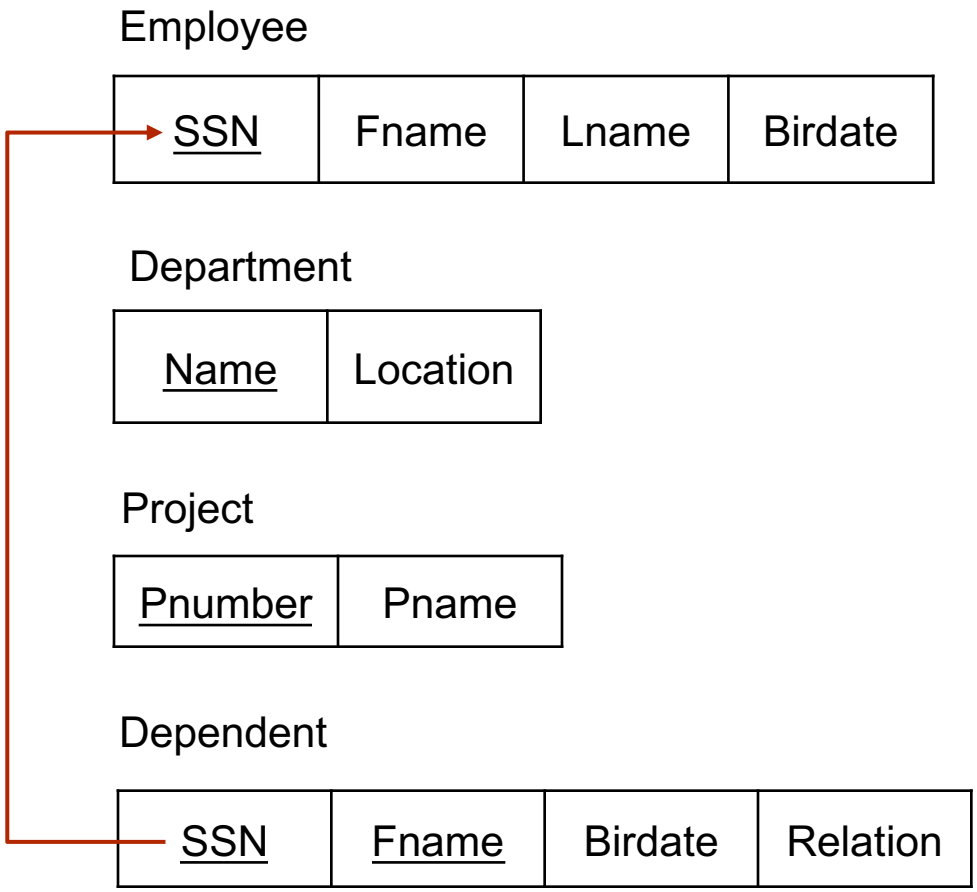
Mapping Weak Entity Types

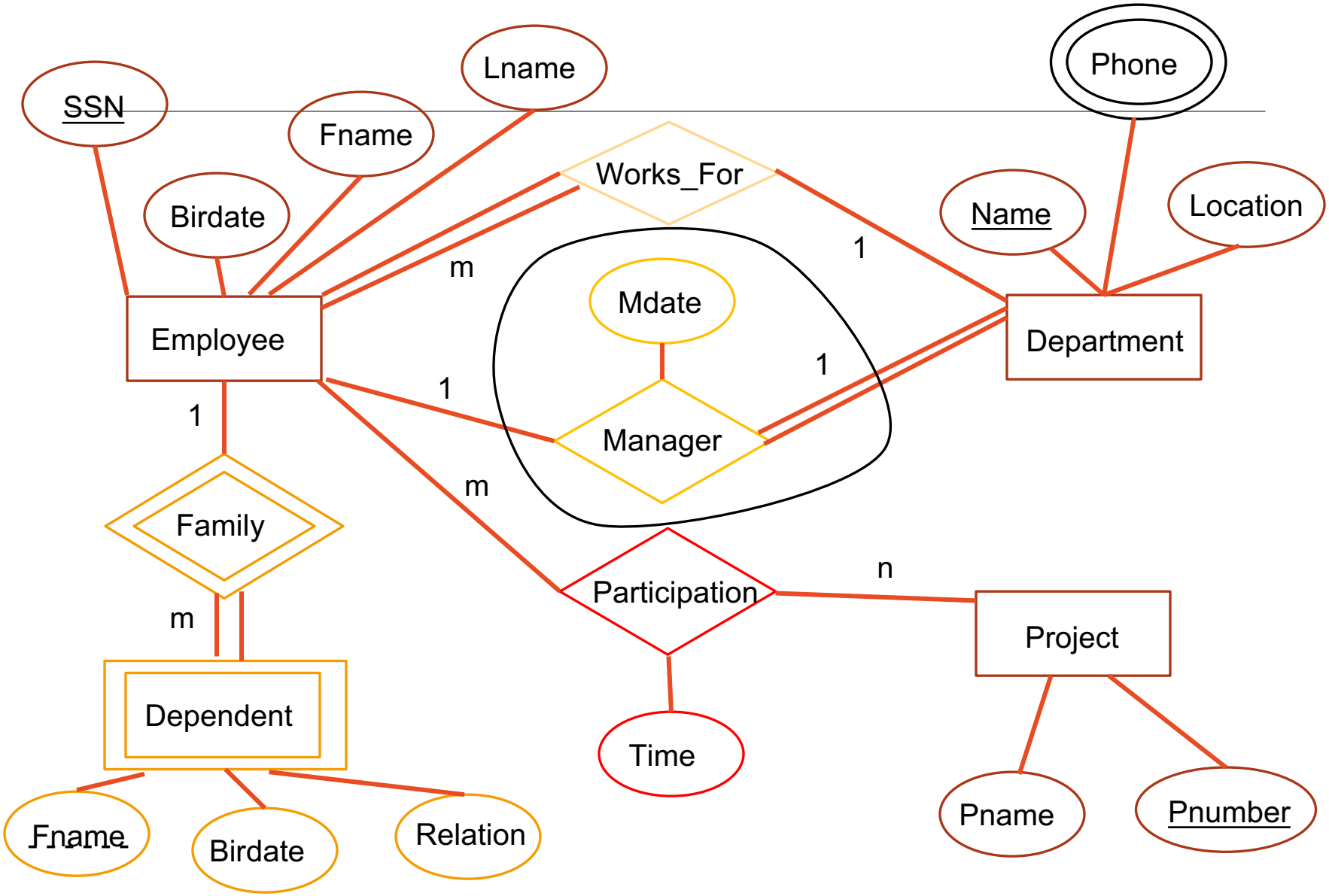


Mapping 1:1 Relationship Types

Step 3: For each *1:1 relationship type* B, let E and F be the participating entity types. Let S and T be the corresponding relations.

- Choose one of S and T (let S be the one that participates totally if there is one).
- Add attributes from the primary key of T to S as a foreign key.
- Add all simple attributes (and simple components of composite attributes) of B as attributes of S.

(Alternatively: merge the two entity types and the relationship into a single relation, especially if ***both participate totally and do not participate in other relationships****).*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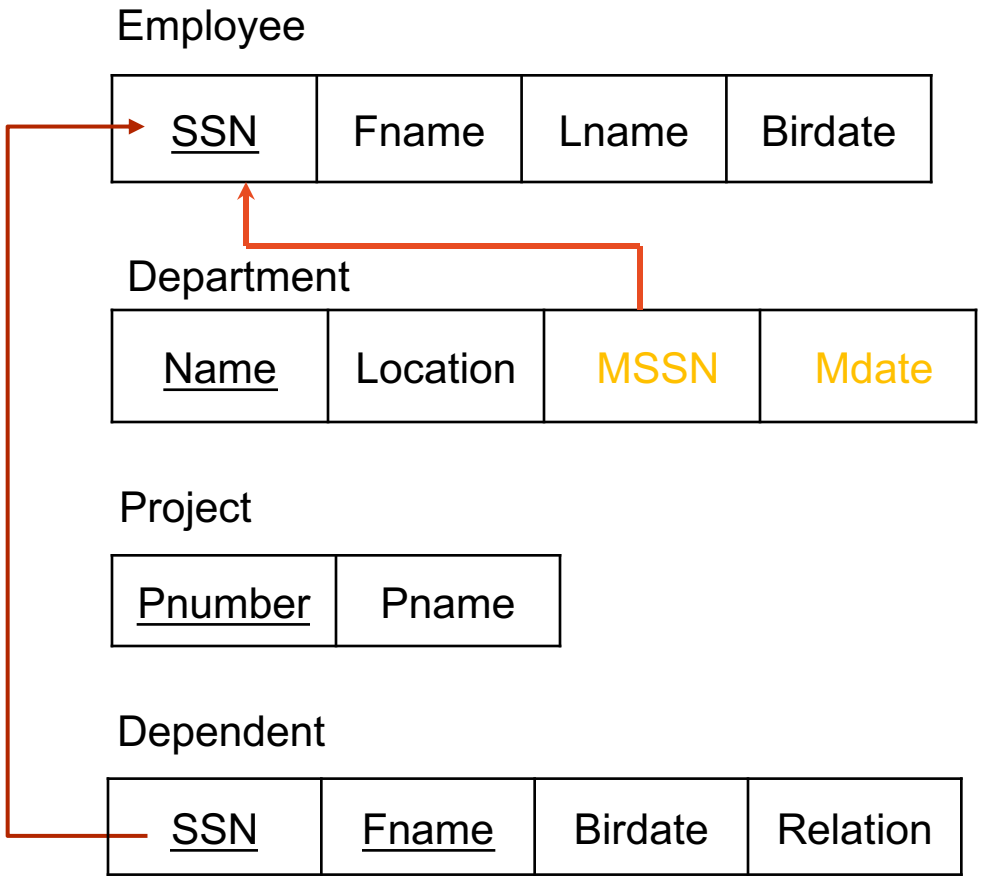
Mapping 1:1 Relationship Types



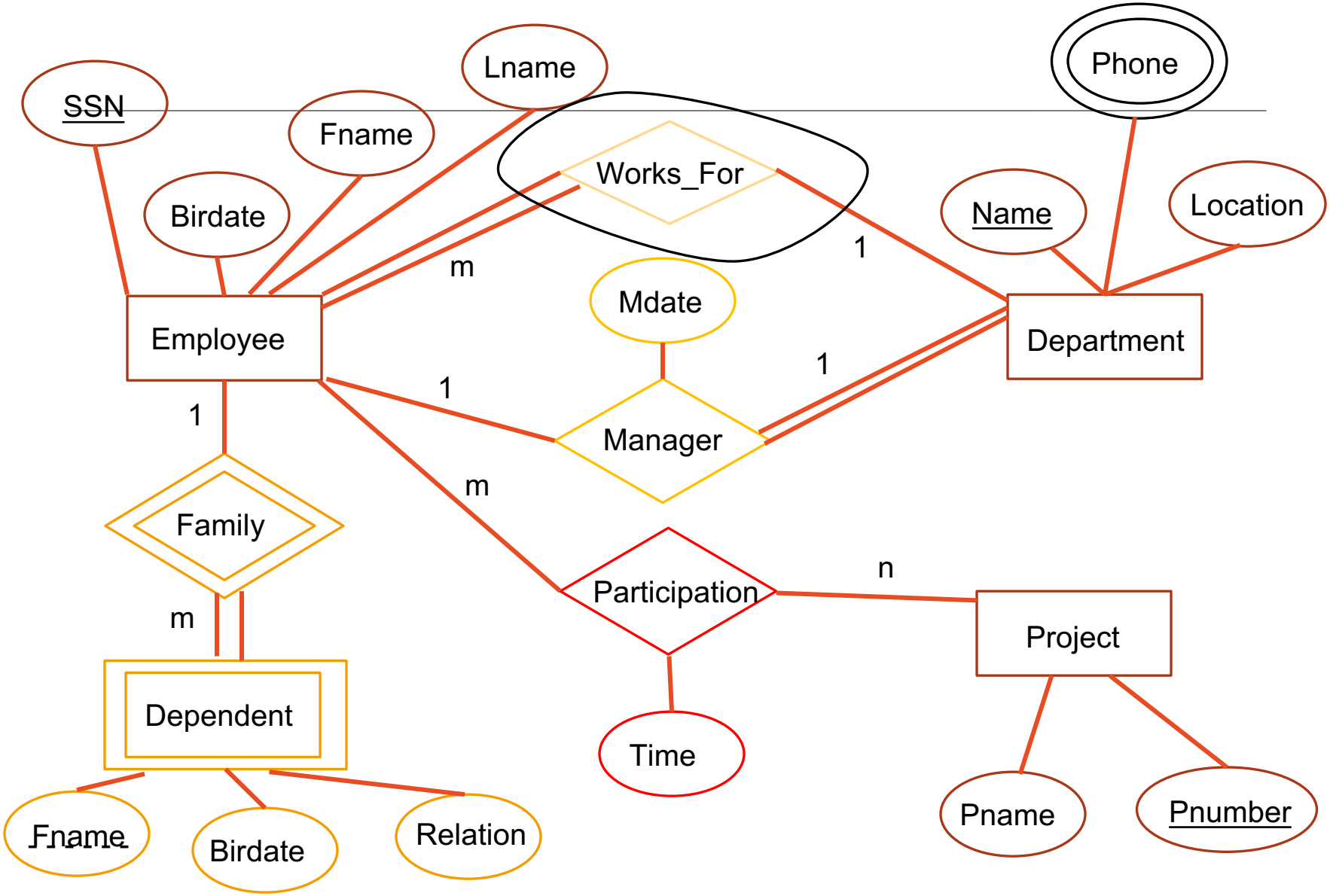
Mapping 1:N Relationship Types

Step 4: For each *1:N relationship type* B, let E and F be the participating entity types. Let S and T be the corresponding relations. E is the entity on the 1 side and F on the N side.

Add to the relation belonging to entity T,

- the attributes from the primary key of S as a foreign key.
- any simple attributes (or simple components of composite attributes) from relationship B.

(Notice that this doesn't add any new tuples, just attributes.)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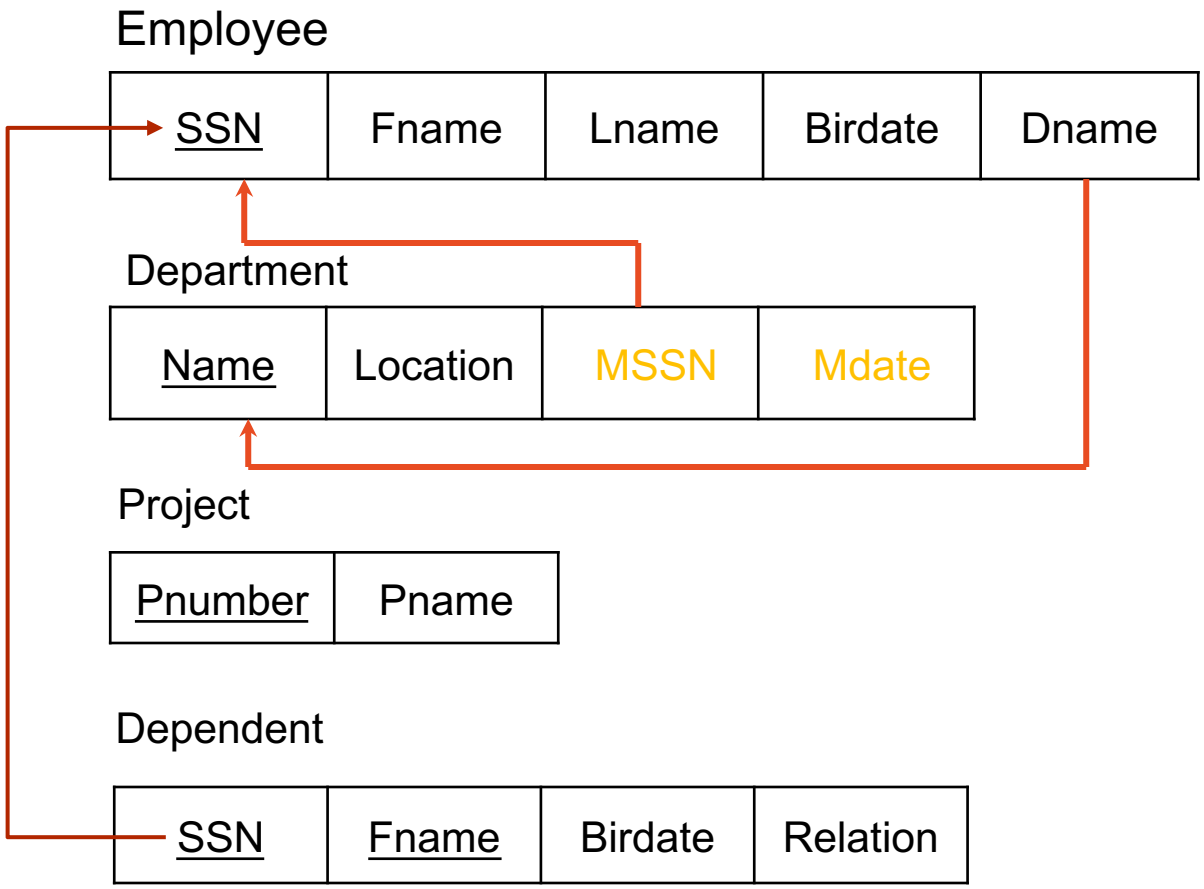
Mapping 1:N Relationship Types



Mapping M:N Relationship Types

Step 5: For each *N:M relationship type* B, let E and F be the participating entity types. Let S and T be the corresponding relations

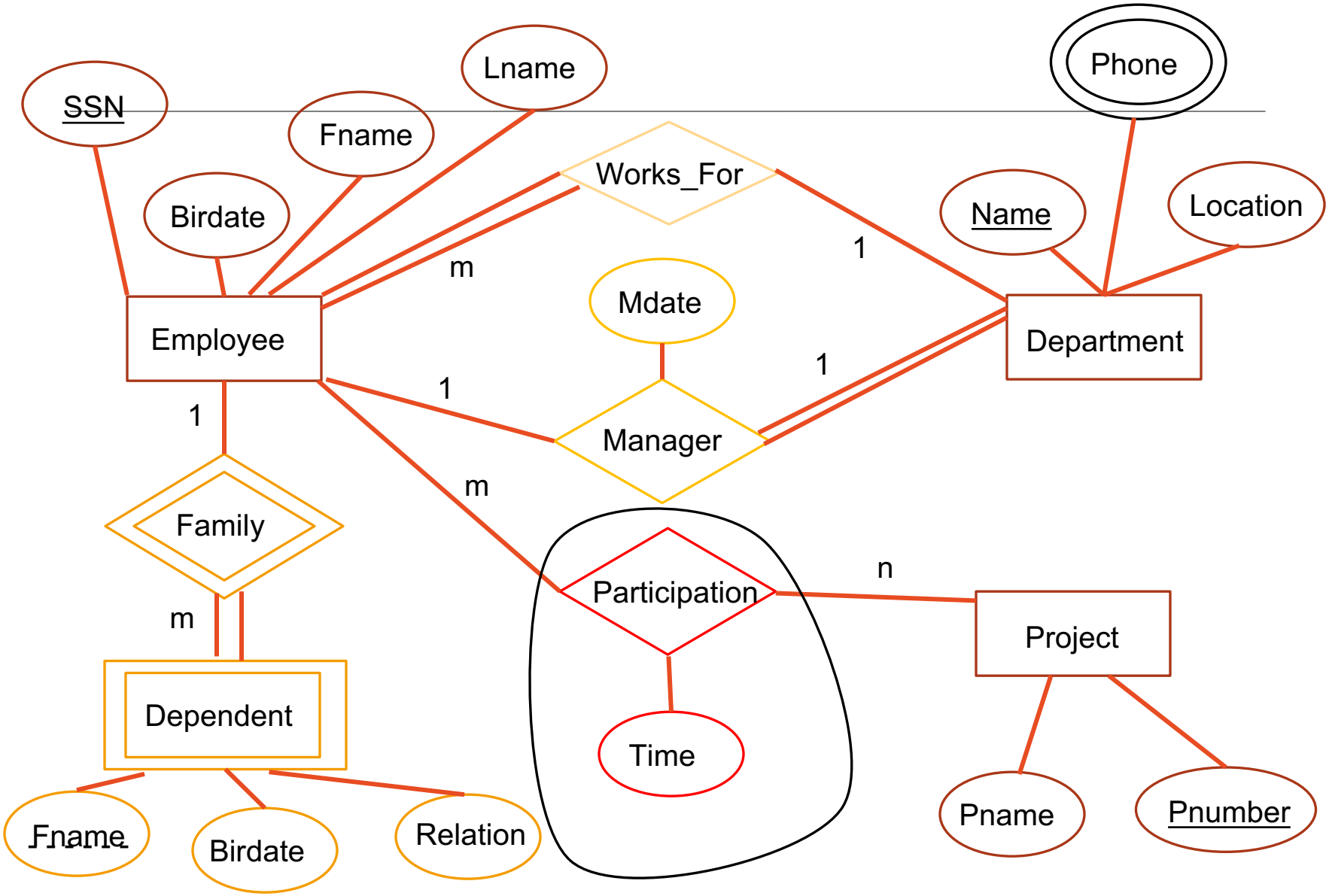
Create a new relation R (*cross-reference*) with

Attributes:

- Attributes from the key of S as foreign key,
- And attributes from the key of T as foreign key,
- And simple attributes, and simple components of composite attributes of relation B.

Key:

- All attributes from the key of S and the key of T.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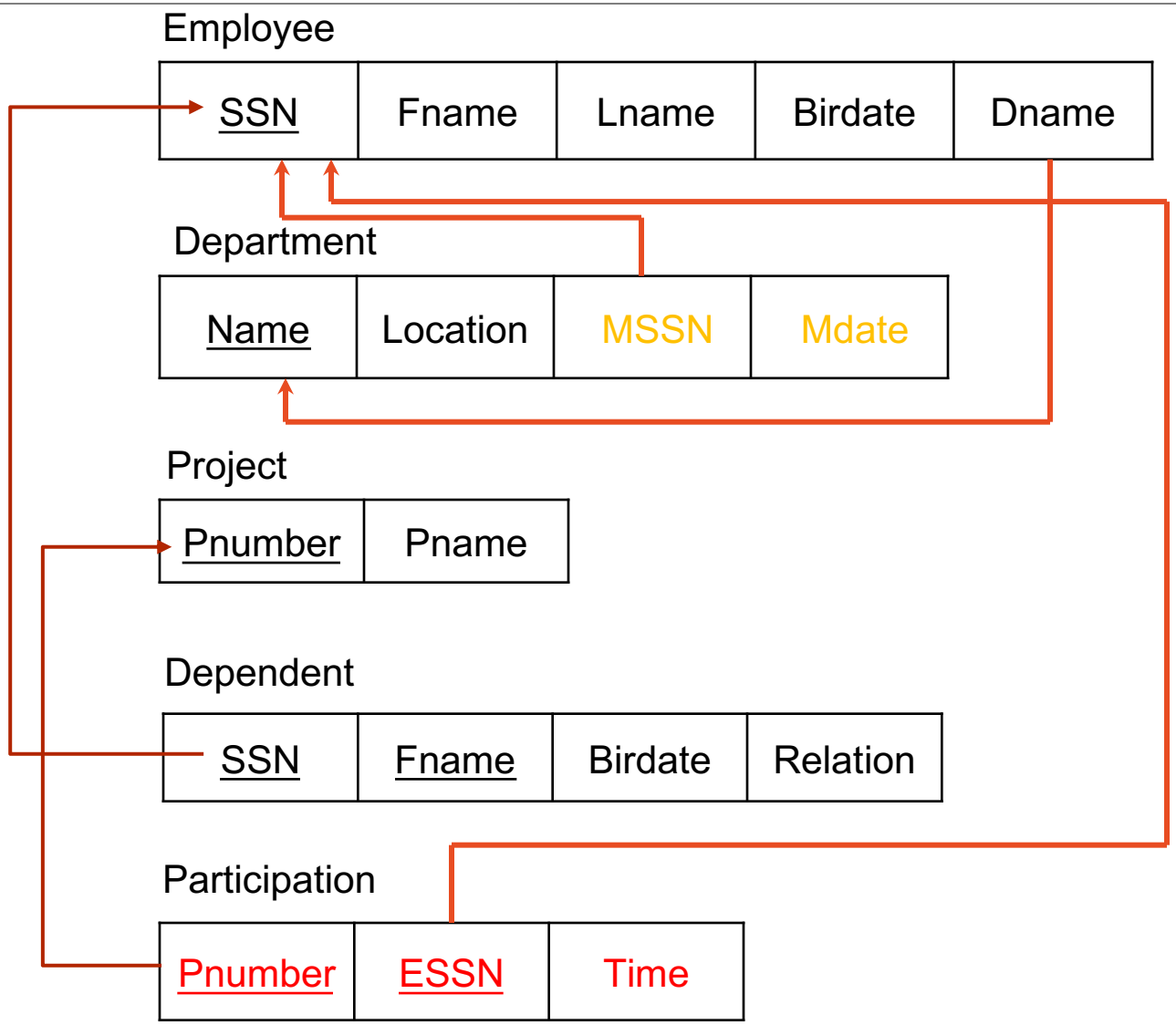
Mapping M:N Relationship Types



Mapping Multivalued Attributes

Step 6: For each *multivalued attribute* A, where A is an attribute of E, create a new relation R.

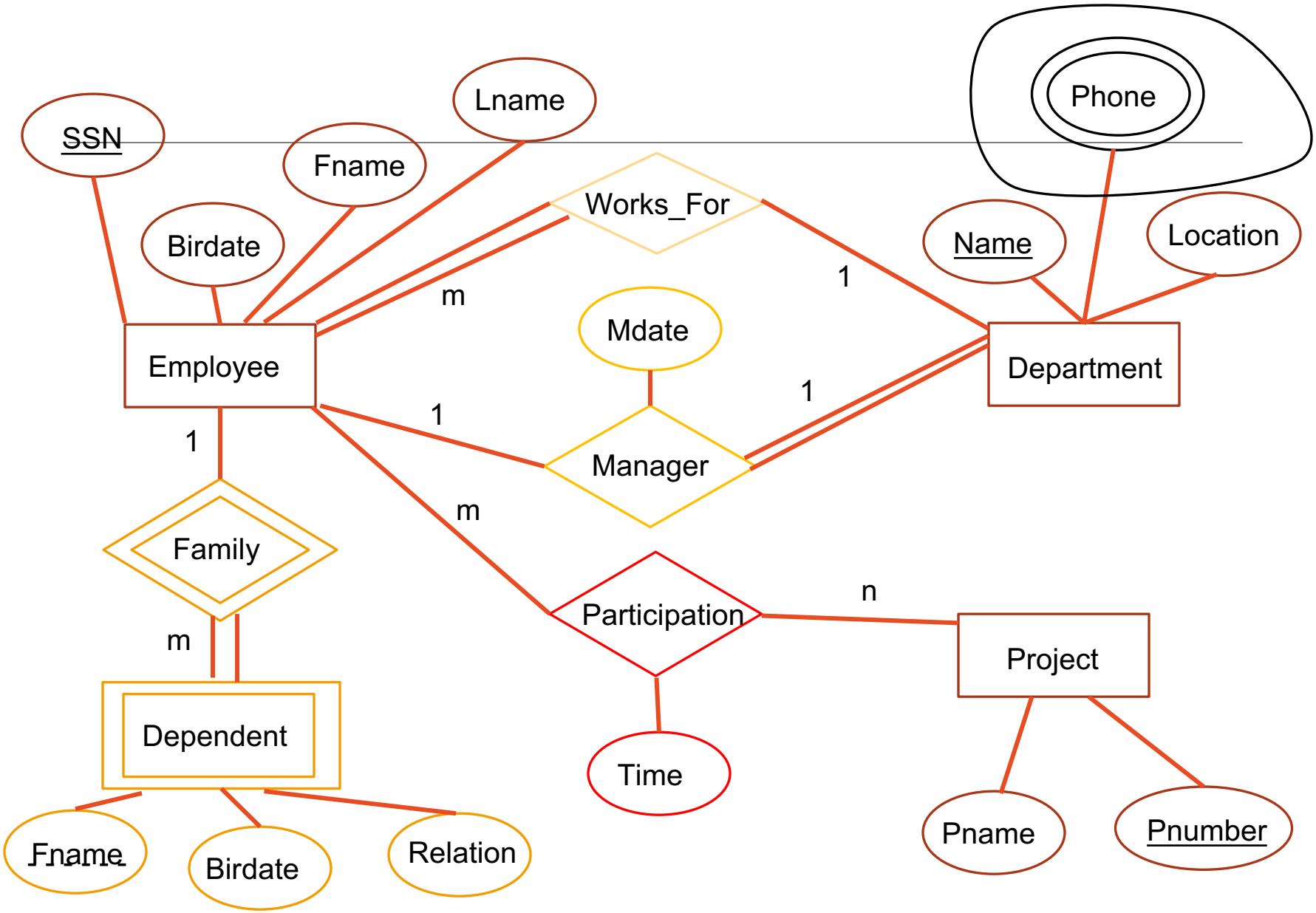
If A is a multivalued simple attribute,

- Attributes of R = Simple attribute A, and key of E as a foreign key.

If A is a multivalued composite attribute,

- Attributes of R = All simple components of A, and key of E as a foreign key.

In both cases, the primary key of R is the set of all attributes in R.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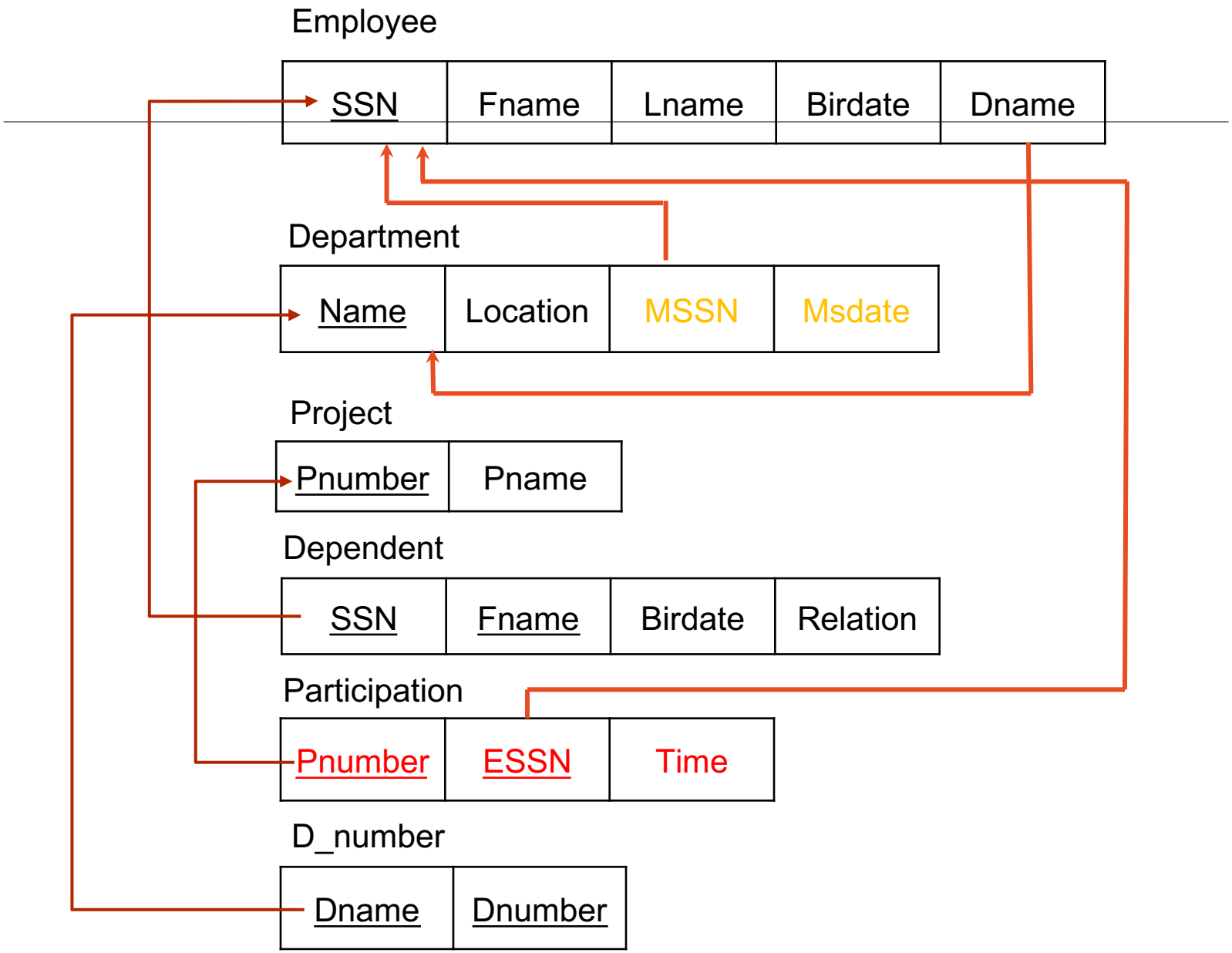
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Mapping N-ary Relationship Types

Step 7: For each *n-ary relationship type* (n > 2), create a new relation S with

Attributes:

- 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.

Key:

- All attributes from the primary keys of the participating entity types

(Advice: binary relationships are simpler to model)

Summary of Mapping

Map Entities first

- Strong Entity Types (Step 1)
- Weak Entity Types (Step 2)

Map Relationship

- 1:1 Relationship Types (Step 3)
- 1:N Relationship Types (Step 4)
- M:N Relationship Types (Step 5)
- N-ary Relationship Types (Step 7)

Mapping

- Multivalued Attributes (Step 6)

ER vs Relational Model

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 key
n-ary relationship type	Relationship relation and n foreign key
Simple Attribute	Attribute
Composite Attribute	Set of simple component attributes
Multivalued Attribute	Relation and foreign key