**Mapping ER-to -Relational Mapping**

**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**

**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.

**Example:** We 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 as shown.

**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 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**: Create the relation DEPENDENT in this step 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.

**Step 3: Mapping of Binary 1:1 Relation 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. Choose one of the relations-S, say-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:** 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.

**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:** 1:N relationship types WORKS\_FOR, CONTROLS, and SUPERVISION in the figure. For WORKS\_FOR we include the primary key DNUMBER of the DEPARTMENT relation as foreign key in the EMPLOYEE relation and call it DNO.

**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 as attributes of S.

**Example:** The M: N relationship type WORKS\_ON from the ER diagram is mapped by creating a relation WORKS\_ON in the relational database schema. The primary keys of the PROJECT and EMPLOYEE relations are included as foreign keys in WORKS\_ON and renamed PNO and ESSN, respectively. Attribute HOURS in WORKS\_ON represents the HOURS attribute of the relation type. The primary key of the WORKS\_ON relation is the combination of the foreign key attributes {ESSN, PNO}.

**Step 6: Mapping of Multi-valued attributes.**

* For each multi-valued 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 multi-valued attribute is composite, we include its simple components.

**Example:** The relation DEPT\_LOCATIONS is created. The attribute DLOCATION represents the multi-valued attribute LOCATIONS of DEPARTMENT. The primary key of R is the combination of {DNUMBER, DLOCATION}.

**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 SUPPY in the ER below. 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}

