

Logical Design

- “During **logical design** you transform the E-R diagrams that were developed during conceptual design into relational database schemas.” p. 218
- Inputs:
- Outputs:

Logical Design

Transforming ER Diagrams into Relations - 1

LOGICAL DESIGN: “During *logical design* you transform the E-R diagrams that were developed during conceptual design into relational database schemas.” p. 218

- **Step 1: Map Regular Entities**
 - Regular entities become relation
 - Entity name typically becomes relation name
 - Entity identifier becomes primary key
- Step 1a: Composite attribute
 - Only include simple component values
- Step 1b: Multi-valued attributes
 - Create two new relations if entity has multi-valued attributes
 - Relation 1 – all attributes except Multi-valued attribute
 - Relation 2 – two attributes as key
 - Attribute 1 = primary key of relation 1 (as foreign key)
 - Attribute 2 = multi-valued attribute
- **Step 2: Map Weak Entities**
 - Create new relation
 - Include all simple attributes
 - Include primary key of owner relation, as foreign key
 - Primary key of this relation is
 - primary key of owner
 - Partial identifier
- **Step 3: Map Binary Relationships**
 - Map One-to-Many
 - Create relation for each entity
 - Include the primary key attribute (and attributes) of the entity on the one-side of the relationship as a foreign key in the relation that is on the many-side of the relationship
 - Map Many-to-Many
 - Create relations for both entities
 - Create additional new relation
 - Include primary key of both original relations as foreign keys in new relation
 - Primary key of new relation to be both foreign keys of original relation (plus additional attributes to ensure that key will be unique)
 - Map One-to-One
 - Create relations for both entities
 - Include the primary key of one relation as the foreign key of the other relation

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Transforming ER Diagrams into Relations - 2

- **Step 4: Map Associative Entities**

- Proceed as with Many to Many Binary relationship

- If Associative Entity does not have Meaningful Unique Identifier (as in Many-to-Many relationship), primary key for new relation is the combination of the primary keys of the original relations (which are included as foreign keys)
- If Associative Entity has Meaningful Unique Identifier – primary key of new entity is the identifier. The primary keys of related entities are included as foreign keys in new relation.

- **Step 5: Map Unary Relationships**

- Unary One-to-Many

- Foreign key attribute is added within the same relation that references the primary key values. **Recursive foreign key** is a foreign key in a relation that references the primary key values of that same relation.

- Unary Many-to-Many

- Create two relations
- Relation 1 represents the entity type
- Relation 2, an associative relation, represents the M:N relationship itself
- Primary key of associative relation has two attributes, where both attributes are primary key of other relation

- **Step 6: Map Ternary (and n-ary) Relationships**

- Create 3 relations to represent participating entities

- Create additional associative relation.

- Default primary key of associative relation has three primary key attributes for participating entity types

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Transforming ER Diagrams into Relations

- **Step 1: Map Regular Entities**
 - Step 1a: Composite attribute
 - Step 1b: Multi-valued attributes
- **Step 2: Map Weak Entities**
- **Step 3: Map Binary Relationships**
 - Map One-to-Many
 - Map Many-to-Many
 - Map One-to-One
- **Step 4: Map Associative Entities**
 - Proceed as with Many-Many Binary relationship
- **Step 5: Map Unary Relationships**
 - Map Unary One-to-Many
 - Map Unary Many-to-Many
- **Step 6: Map Ternary (and n-ary) Relationships**