

# Step 2: Representing Binary Relationships

Each (binary) relationship between two entities has a cardinality on both sides of the relationship. The cardinalities have minimum and maximum values. The cardinalities may be:

- 0 or 1
- 1 and only 1
- 0 or more
- 1 or more

We can derive 3 types of binary relationships by looking at the maximum cardinalities on both ends of the relationship. Since the maximum cardinality of any relationship is 1 or is *more* (denoted M or N), then a binary relationship can be describe as one of the following:

- 1:1 (one-to-one)
- 1:M (one-to-many)
- M:N (many-to-many)

Below we look at these relationships and augment our relation schema. When we do, we will be referencing only the maximum values of the cardinalities. For example, when we talk of one-to-many relationships we talk about relations where there is at most 1 on one side of the relation and at most, many, on the other.

Customer 11 —— 1M Order

For each of the binary relationships in your E-R diagram, you should have already created relations for each of the two entities (strong or weak) involved in the relationship.

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## Mapping Binary Many-to-Many (M:N) Relationships

Create a new relation for each M:N binary relationship.

- The primary key attributes of the two relations involved in the relationship become the primary key of the new relation.
- Any non-key attributes in the relations involved in the relationship or in an associate entity that are *associated with the M:N relationship* are included as attributes in the new relation and removed from the relation involved in the relationship.

M - EMPLOYEE(EmployeeID, FirstName, LastName)

M - COURSE(CourseID, Title, Instructor)

ENROLLED-EMPLOYEE(EmployeeID, CourseID, Semester, Grade)

Above, we assume there is an associative entity for the relationship that has Semester and Grade as attributes. These attributes are added to the ENROLLED-COURSES relation.

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## Mapping Binary One-to-Many Relationships

No new relation is created for one-to-many relationships. Instead, we simply include the primary key attribute(s) of the relation on the one-side as foreign keys in the relation that is on the many-side.

1 - CUSTOMER(CustomerID, CompanyName, StreetAddress, City, State, Zip)

M - ORDER(OrderID, CustomerID, OrderDate, TotalCost)

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## Mapping Binary One-to-One Relationships

A one-to-one relationship is a special case of one-to-many relationship.

Often, one side of the relationship is optional and the other side is mandatory.

Suppose we have a relationship that states that a Nurse can supervise 0 or 1 Care Centers, and that a Care Center is supervised by 1 and only 1 Nurse.

1-mandatory NURSE (NurseID, FirstName, LastName)

1-optional CARE\_CENTER (CenterID, StreetAddress, City, State, Zip)

To handle this relationship we include the primary key attribute(s) of the relation on the mandatory side as foreign keys in the relation that is on the optional-side.

NURSE (NurseID, FirstName, LastName)

CARE\_CENTER (CenterID, SupervisingNurse, StreetAddress, City, State, Zip)

Note that we might also have another 1:M relationship between Nurse and CareCenter that states a Nurse is employed by one and only one Care Center and that a Care Center employs zero or more Nurses. This relationship would be handled separately.