



Figure 6.13 Cardinality limits on relationship sets.

is the minimum and h the maximum cardinality. A minimum value of 1 indicates total participation of the entity set in the relationship set; that is, each entity in the entity set occurs in at least one relationship in that relationship set. A maximum value of 1 indicates that the entity participates in at most one relationship, while a maximum value $*$ indicates no limit.

For example, consider Figure 6.13. The line between *advisor* and *student* has a cardinality constraint of 1..1, meaning the minimum and the maximum cardinality are both 1. That is, each student must have exactly one advisor. The limit 0..* on the line between *advisor* and *instructor* indicates that an instructor can have zero or more students. Thus, the relationship *advisor* is one-to-many from *instructor* to *student*, and further the participation of *student* in *advisor* is total, implying that a student must have an advisor.

It is easy to misinterpret the 0..* on the left edge and think that the relationship *advisor* is many-to-one from *instructor* to *student*—this is exactly the reverse of the correct interpretation.

If both edges have a maximum value of 1, the relationship is one-to-one. If we had specified a cardinality limit of 1..* on the left edge, we would be saying that each instructor must advise at least one student.

The E-R diagram in Figure 6.13 could alternatively have been drawn with a double line from *student* to *advisor*, and an arrow on the line from *advisor* to *instructor*, in place of the cardinality constraints shown. This alternative diagram would enforce exactly the same constraints as the constraints shown in the figure.

In the case of nonbinary relationship sets, we can specify some types of many-to-one relationships. Suppose a *student* can have at most one instructor as a guide on a project. This constraint can be specified by an arrow pointing to *instructor* on the edge from *proj_guide*.

We permit at most one arrow out of a nonbinary relationship set, since an E-R diagram with two or more arrows out of a nonbinary relationship set can be interpreted in two ways. We elaborate on this issue in Section 6.5.2.

6.5 Primary Key

We must have a way to specify how entities within a given entity set and relationships within a given relationship set are distinguished.