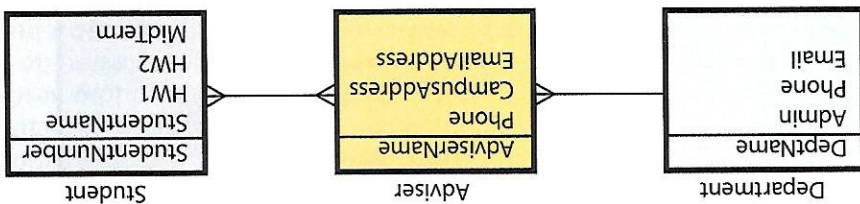


Figure 5-19 Sample Relationships Version 1



the other attributes. For this sample data, *Accounting* has three professors—Jones, Wu, and Lopez—and *Finance* has two professors—Smith and Greene.

The relationship between *Advisers* and *Students* is a bit more complicated, because in this example an adviser is allowed to advise many students, and a student is allowed to have many advisers. Perhaps this happens because students can have multiple majors. In any case, note that Professor Jones advises students 100 and 400 and that student 100 is advised by both Professors Jones and Smith.

Diagrams like the one in Figure 5-18 are too cumbersome for use in database design discussions. Instead, database designers use diagrams called **entity-relationship (E-R) diagrams**. Figure 5-19 shows an E-R diagram for the data in Figure 5-18. In this figure, all of the entities of one type are represented by a single rectangle. Thus, there are rectangles for the *Department*, *Adviser*, and *Student* entities. Attributes are shown as before in Figure 5-17.

Additionally, a line is used to represent a relationship between two entities. Notice the line between *Department* and *Adviser*, for example. The forked lines on the right side of that line signify that a department may have more than one adviser. The little lines, which are referred to as **crow's feet**, are shorthand for the multiple lines between *Department* and *Adviser* in Figure 5-18. Relationships like this one are called **1:N**, or **one-to-many relationships**, because one department can have many advisers, but an adviser has at most one department.

Now examine the line between *Adviser* and *Student*. Notice the short lines that appear at each end of the line. These lines are the crow's feet, and this notation signifies that an adviser can be related to many students and that a student can be related to many advisers, which is the situation in Figure 5-18. Relationships like this one are called **N:M**, or **many-to-many relationships**, because one adviser can have many students and one student can have many advisers.

Students sometimes find the notation **N:M** confusing. Interpret the *N* and *M* to mean that a variable number, greater than one, is allowed on each side of the relationship. Such a relationship is not written *N:N*, because that notation would imply that there are the same number of entities on each side of the relationship, which is not necessarily true. *N:M* means that more than one entity is allowed on each side of the relationship and that the number of entities on each side can be different.

Figure 5-20 shows the same entities with different assumptions. Here, advisers may advise in more than one department, but a student may have only one adviser, representing a policy that students may not have multiple majors. Which, if either, of these versions is correct? Only the users know. These alternatives illustrate the kinds of questions you will need to answer when a database designer asks you to check a data model for correctness.

Figures 5-19 and 5-20 are typical examples of an entity-relationship diagram. Unfortunately, there are several different styles of entity-relationship diagrams. This

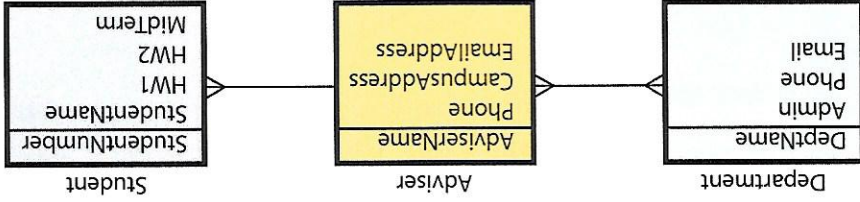


Figure 5-20 Sample Relationships Version 2