We can see that certain insertion and deletion requirements follow from the constraints that apply to a given generalization or specialization. For instance, when a total completeness constraint is in place, an entity inserted into a higher-level entity set must also be inserted into at least one of the lower-level entity sets. An entity that is deleted from a higher-level entity set must also be deleted from all the associated lower-level entity sets to which it belongs.

6.8.5 Aggregation

One limitation of the E-R model is that it cannot express relationships among relationships. To illustrate the need for such a construct, consider the ternary relationship *proj_guide*, which we saw earlier, between an *instructor*, *student* and *project* (see Figure 6.6).

Now suppose that each instructor guiding a student on a project is required to file a monthly evaluation report. We model the evaluation report as an entity *evaluation*, with a primary key *evaluation_id*. One alternative for recording the (*student*, *project*, *instructor*) combination to which an *evaluation* corresponds is to create a quaternary (4-way) relationship set *eval_for* between *instructor*, *student*, *project*, and *evaluation*. (A quaternary relationship is required—a binary relationship between *student* and *evaluation*, for example, would not permit us to represent the (*project*, *instructor*) combination to which an *evaluation* corresponds.) Using the basic E-R modeling constructs, we obtain the E-R diagram of Figure 6.19. (We have omitted the attributes of the entity sets, for simplicity.)

It appears that the relationship sets *proj_guide* and *eval_for* can be combined into one single relationship set. Nevertheless, we should not combine them into a single

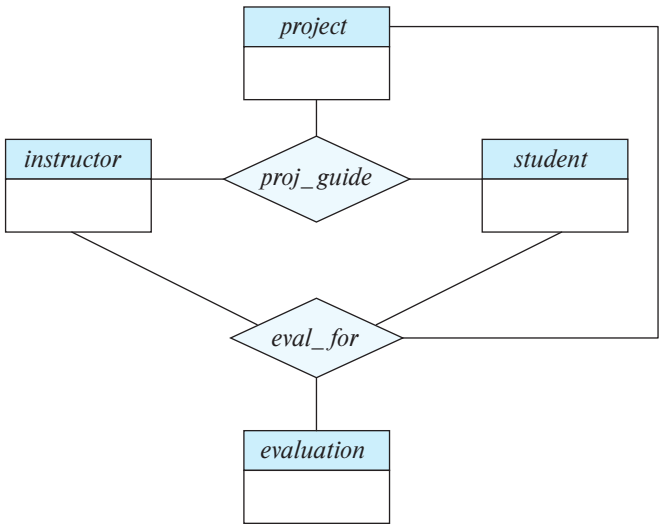

Figure 6.19 E-R diagram with redundant relationships.