

treatments. A patient may have different physicians at different times. The database keeps all information about prescriptions and treatments, both past and current. When appointments are made, the information about scheduled date and time is recorded. No patient is ever scheduled for two visits on one day. The center has several physical therapists, and a patient may be treated by different physical therapists on different visits. When a patient makes a visit at an appointed time, the name of the therapist, the treatment, the date, the time, and the equipment used are all recorded for that visit. Each of these has only one value for the visit. This information will be used later for insurance billing, which is not part of this database. Draw a complete E-R diagram for this example.

- 3.9**
- Assume the Seller entity set in Exercise 3.3 is specialized into Private and Dealer. Show how the specialization is represented on an EE-R diagram, making up attributes as needed and stating any assumptions you need to make.
 - Given the specialization in Part (a), add relationships and/or additional diagram elements that show:
 - All sellers can have a rating assigned by the collector.
 - Private sellers are usually recommended by a source such as a friend or another collector.
 - Most dealers have a newsletter or a webpage that they use to advertise their offerings
 - Using (min,max) notation, add constraints for the relationships, stating any additional assumptions you need to make.
- 3.10** Develop an EE-R diagram for the college student and activities described in Exercise 3.4, but expand it to cover graduate students as well as undergraduates. Graduate students can participate in the clubs as members, or they can serve as moderators of the clubs. A graduate student, like an undergraduate, has one academic advisor, but may also have a thesis advisor, who oversees his or her thesis research.
- 3.11** Develop an EE-R diagram for the dental group described in Exercise 3.5, but expand it by assuming that some of the dentists are surgeons, who can perform oral surgery. Also assume some of the professionals are dental hygienists, who can perform routine work such as cleaning and taking X-rays. A patient typically begins an ordinary visit by starting with a dental hygienist who performs routine work, and then a dentist who does a checkup during the same initial

visit. The work needed is usually determined at this visit. If follow-up visits are required, each of the next visits will be with one dentist. If a patient requires oral surgery, at least one of his or her visits must be with one of the surgeons, even though the rest of the work needed might be performed by his or her regular dentist. When surgery is performed, there must be a qualified assistant present. Only some of the hygienists are qualified to assist in surgeries. Assume this database does not keep track of appointments, only of actual visits, work, billing, and payments.

- 3.12** Develop an EE-R diagram for the interior design firm described in Exercise 3.6, but expand it by assuming the clients can either be individuals or corporations. Also assume the contractors can be licensed professionals with various specialties (such as plumbers, electricians, or carpenters) or hourly laborers.
- 3.13** Develop an EE-R diagram for the automobile body repair shop described in Exercise 3.7, but assume the shop is expanding to perform mechanical repairs as well as body work. Body work can be done by a technician, but all mechanical repairs require a licensed mechanic. Jobs now may require one technician to handle the body work (if any) and a licensed mechanic to do the mechanical repairs (if any).
- 3.14** Develop an EE-R diagram for the physical therapy center described in Exercise 3.8, but expand it to assume that some visits require the use of specialized equipment for electrotherapy, ultrasound, hydrotherapy, and so on, and the patient is charged for each use of such equipment. Patients may also be supplied with special devices to take home, such as exercise bands, neck pillows, and so on, and the patient is charged for these special supplies.