

## Database Programming

### Homework #2: EER Diagrams

**Important note about this homework: These are original problems. There are no solutions posted anywhere for these problems, because I made them up. There are two diagrams that are discussed in a tangential way in a previous year's assignment, but even those were not part of the homework, and there is no solution available. In fact, as of this writing, I haven't even written the solutions yet. This is to your benefit, as these concepts are fundamental to database design and this homework can help you to advance these skills.**

1. Subtype discriminators were left off the figures a, b and c, included on this homework assignment. Please recall that a subtype discriminator is the attribute along which subclasses are classified. It is NOT the "d" or "o" of the disjointedness constraint. It is NOT the single or double lines of the completeness constraint. It is the actual attribute that you use to determine what your subtypes will be. (see slides or review videos if necessary because it's not in your book.) Add subtype discriminators for each figure. If necessary, create a new attribute for the discriminator. Do not draw a new diagram. Just write what the subtype discriminator is. Make sure that the subtype discriminator makes sense semantically. Simply writing "student type" is meaningless. For figure c the subtype discriminator is residential\_or\_outpatient. For Figure d, the subtype discriminator is mfg\_or\_purch. For c and d: do you think that there is a different set of circumstances that might require a different subtype discriminator? Think of a situation for c and also for d, where you might use a different subtype discriminator. Write the scenario, and then also write what subtype discriminator you would use. SEE NOTE ON SHOWING SUBTYPE DISCRIMINATORS AT THE END OF THE ASSIGNMENT.
  
2. Consider the following two cases. For each case, draw the ERD or EERD, and explain if you would consider creating a supertype/subtype relationship for this problem? Why or why not? If you do create a supertype/subtype EERD, be sure to add the subtype discriminator in the appropriate entity or entities.
  - a. A bank classifies its accounts into two categories: personal and business. The bank wants to record the following data for all accounts: accountID, accountType, accountBalance, customerID. The bank also keeps track of customer data: customerID, customerName, customerAddress. A customer may have any number or type of accounts, and the customer may arrange a meeting with a member of the bank at any time. The bank records a history of the dates of every meeting.
  - b. A bank classifies its accounts into two categories: personal and business. The bank wants to record the following data for all accounts: accountID, accountType, accountBalance, accountOwner. The bank also has a personal banker for each business account. The personal banker meets with the account owner once a year, and the bank records the date of the most recent annual meeting.
  
3. Consider the following case. Draw the ERD or EERD, and explain if you would consider creating a supertype/subtype relationship for this problem? Why or why not? If you do, create a supertype/subtype EERD, be sure to add the subtype discriminator in the appropriate entity or entities.

CovidClinic maintains risk-related data about their patients. Data maintained about patients include: patientID, patientName, patientContactInfo, age, height, weight. Patients are considered "not at risk" or "at risk". Patients who are not at risk include patients who have been vaccinated and patients who have already had covid. The clinic records the dates of vaccination and/or the date of covid recovery. If a patient who has had covid was hospitalized, the dates of the hospitalization (beginning and ending date) are recorded. If the patient experienced any side effects to the vaccine, these are also recorded. The clinic records the most recent antibodies level of not-at-risk patients and the date of the antibodies level. In our scenario, patients who are vaccinated do not get covid, and patients who have had covid do not need the vaccination.

Patients who are "at risk" may be considered "high risk" or "low risk". The clinic records a list of the risk factors of all patients who are at risk. All patients who are at risk are sent regular reminders about how to track their symptoms and how to get tested or get help if needed. The date of the last reminder to the patient is also recorded.

High risk patients are contacted by a nurse once/week to assess their symptoms. The name of the nurse, date and the summary evaluation of the nurse contact is recorded.

4. Build an EER diagram to capture the following scenario. Be sure to include total/partial designations, and overlap/disjoint overlap. Show specializations when they are necessary to show and do not show them (even if they exist), when they are not necessary to the design of the database. Be sure to include the subtype discriminators:

CovidClinic staff are feeling overwhelmed with all of the new protocols and the spikes in the cases of this pandemic. They are concerned that their lack of familiarity with some of the unusual challenges and also the number of cases may cause them to give less-than-optimal care to their patients. Therefore, CovidClinic has instituted a mentoring program to help train and support their staff and patients.

CovidClinic has several different types of people in their clinic. These would include medical employees (doctors, psychologists, nurses, clinical staff (such as phlebotomists, etc.)), administrative and support staff (such as clerical workers and so forth), who are also employees. Patients and mentors are also persons about whom CovidClinic wants to track. Mentors can be current or past employees, current or past patients, or outside volunteers or consultants who have had some prior experience with covid and are able and willing to provide guidance or support to other members of CovidClinic community.

CovidClinic retains basic contact information about every person associated with the clinic. This would be things like a PersonID, name, address and phone#. For Employees, the clinic stores the Date Of Hire and the job title. Every person who expresses an interest in having a mentor can be assigned one (but only one). Every person who feels qualified in serving as a mentor can request to serve as a mentor to as many people as the mentor feels capable of helping. There are many categories of mentoring that are provided. These can include things like counseling, providing training in vaccination, testing and scheduling, and several other type of training and support. CovidClinic keeps track of the different kinds of mentoring services that different mentors can provide.

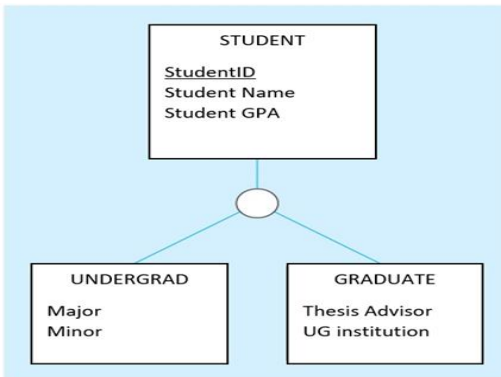
As part of its efforts, some CovidClinic administrators give monthly zoom informational sessions to the public. The title, description, administrator, date and attendance for each zoom session are stored.

CovidClinic provides further support to the community by providing free or reduced rate mental health therapies due to the stress of covid. These sessions can only be provided by psychologists or psychiatrists (who are physicians). These therapy sessions are scheduled individually and a record is kept of the therapist, the patient and the date of the session. As part of the special covid support program CovidClinic has extended this service to include not only patients but any member of the CovidClinic community.

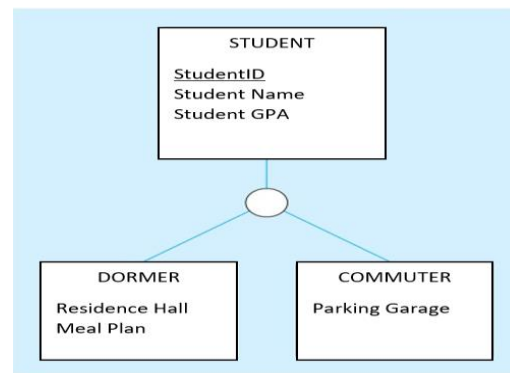
5. Consider the [MountainView Hospital EER Diagram](#). Assume simple identifiers such as PersonID, CareCenterID and so forth. Answer the following questions.
  - a. According to this diagram, can a Volunteer be a Patient?
  - b. According to this diagram, can a Technician also be a Physician?
  - c. According to this diagram, can a Technician also be a Nurse?
  - d. According to this diagram, is Vol Serv History (Volunteer Service History) an associative entity?
  - e. What is the key of Physician? Of Employee? Of Volunteer? Of Nurse?
  - f. According to this diagram, is Assigned an associative entity?
  - g. According to this diagram, how many Staff people are employed in a Work Unit? (One or Many?)
  - h. According to this diagram, how many Nurses are assign to a Care Center? (One of Many?)
  - i. According to this diagram, now many Nurses are in charge of a Care Center? (One or Many?)
  - j. According to this diagram, how many RNs can supervise one LPN? (One or Many?)
  - k. According to this diagram, how many LPNs an one RN supervise? (One or Many?)
  - l. According to this diagram, is a Care Center part of a Work Unit?
  - m. According to this diagram, is a Work Unit a type of Care Center?

- n. According to this diagram the same patient can sometimes be an Outpatient or sometimes be a Resident—TRUE or FALSE.
- o. Change the diagram: Right now, it looks like a bed is assigned to a specific Care Center. But we'd like to be flexible, and we want to be able to reassign beds, as needed, to different Care Centers. So we'd like to keep a history of which Care Centers have which beds, and the date that a bed was assigned to specific Care Center. Create the ER diagram for just that segment of this EERD that would require changing.
- p. Change the diagram: Nurses have been complaining that they are moving too much from one Care Center to another. They will now be assigned to only one Care Center. Create the ER diagram for just that segment of this EERD that would require changing.

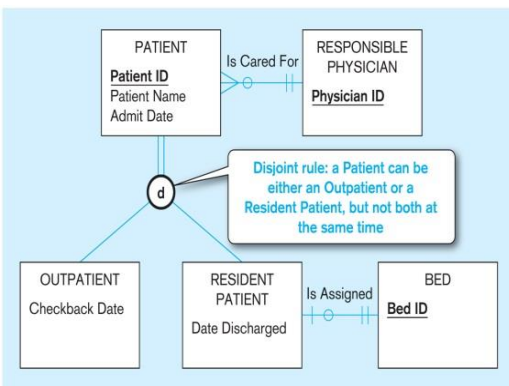
Problem 1-a



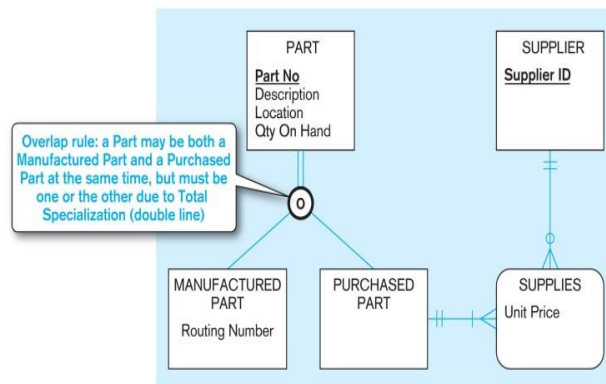
Problem 1-b:



Problem #1-c:



Problem 1-d:



Note about showing subtype discriminators:

Subtype discriminators are best shown as below. Show the attribute that determines the classes (in this case, EmployeeType), and then on the different branches you can show the values of that attribute that classify an instance into one of those classes.

