



College of Electrical & Mechanical Engineering, NUST



Department of Computer Engineering

DATABASE ENGINEERING **(EC-240)**

LAB MANUAL # 05

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Lab#05: Enhanced Entity Relationship Diagram

Lab Objective:

To introduce students with enhanced entity relationship diagram.

Lab Description:

A model has resulted from extending the original E-R model with new modeling constructs is called enhanced entity relationship model.

Enhanced Entity Relationship Model Constructs:

- **Supertype:** A generic entity type that has a relationship with one or more subtypes.
- **Subtype:** A subgrouping of the entities in an entity type that is meaningful to the organization and that shares common attributes or relationships distinct from other subgroupings.
- **Generalization:** The process of defining a more general entity type from a set of more specialized entity types.
- **Specialization:** The process of defining one or more subtypes of the supertype and forming supertype/subtype relationships.

Constraints in Supertype / Subtype relationship:

- **Completeness Constraint:** A type of constraint that addresses whether an instance of a supertype must also be a member of at least one subtype.
 - a. **Total Specialization rule:** A rule that specifies that each entity instance of a supertype must be a member of some subtype in the relationship.
 - b. **Partial Specialization:** A rule that specifies that an entity instance of a supertype is allowed not to belong to any subtype.
- **Disjointness Constraint:** A constraint that addresses whether an instance of a supertype may simultaneously be a member of two (or more) subtypes.
 - a. **Disjoint Rule:** A rule that specifies that an instance of a supertype may not simultaneously be a member of two (or more) subtypes.
 - b. **Overlap Rule:** A rule that specifies that an instance of a supertype may simultaneously be a member of two (or more) subtypes.



Subtype Discriminator: An attribute of a supertype whose values determine the target subtype or subtypes. Subtype discriminator is a composite attribute when there is an overlap rule.

- **Disjoint Subtype**
- **Overlapping Subtype**

Example:

Suppose that you are asked to model the human resources in a university. Using specialization (a top-down approach), you might proceed as follows.

Starting at the top of a hierarchy, model the most general entity type first. In this case, the most general entity type is PERSON. List and associate all attributes of PERSON.

Next, define all major subtypes of the root. In this example, there are three subtypes of PERSON: EMPLOYEE, STUDENT and ALUMNUS.

Assuming that there are no other types of persons of interest to the university, the total specialization rule applies, as shown in the figure. A person might belong to more than one subtype (e.g., ALUMNUS and EMPLOYEE), so the overlap rule is used. The next step is to evaluate whether any of the subtypes already defined qualify for further specialization. In this example, EMPLOYEE is partitioned into two subtypes: FACULTY and STAFF.

Notice that in this example the subtype EMPLOYEE becomes a supertype to FACULTY and STAFF. Because there may be types of employees other than faculty and staff (such as student assistants), the partial specialization rule is indicated.

However, an employee cannot be both faculty and staff at the same time. Therefore, the disjoint rule is indicated in the circle. Two subtypes are also defined for STUDENT: GRADUATE STUDENT and UNDERGRAD STUDENT. Notice that total specialization and the disjoint rule are specified.

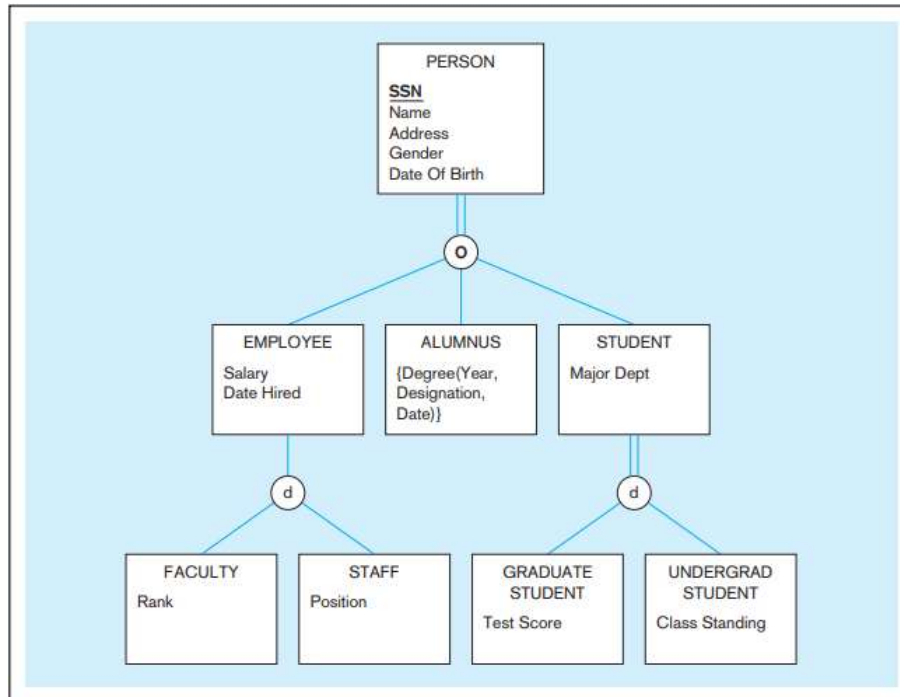
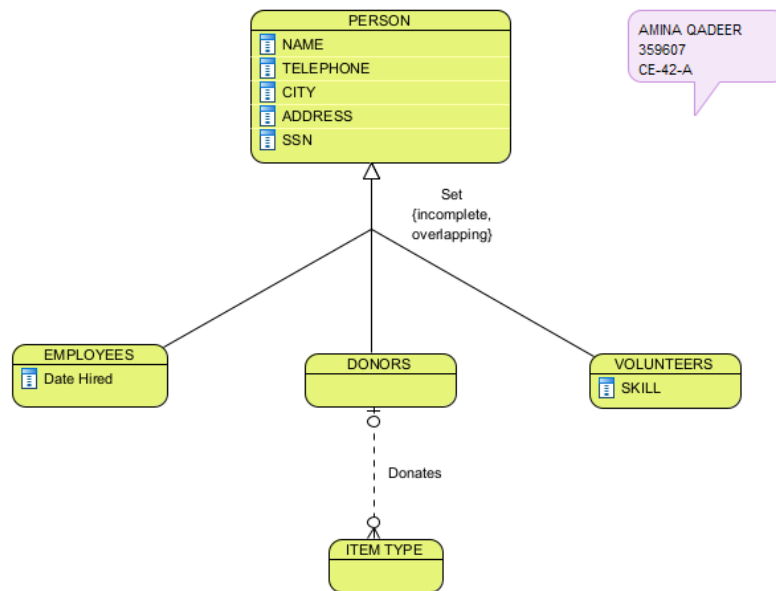


Figure 5-1

Lab Tasks:

01. Consider the following set of requirements draw an EER diagram.

A nonprofit organization depends on a number of different types of persons for its successful operation. The organization is interested in the following attributes for all of these persons: SSN, Name, Address, City/State/Zip, and Telephone. Three types of persons are of greatest interest: employees, volunteers, and donors. Employees have only a Date Hired attribute, and volunteers have only a Skill attribute. Donors have only a relationship (named Donates) with an Item entity type. A donor must have donated one or more items, and an item may have no donors, or one or more donors. There are persons other than employees, volunteers, and donors who are of interest to the organization, so that a person need not belong to any of these three groups. On the other hand, at a given time a person may belong to two or more of these groups (e.g., employee and donor).



Based on the requirements, the EER diagram would consist of the following entities:

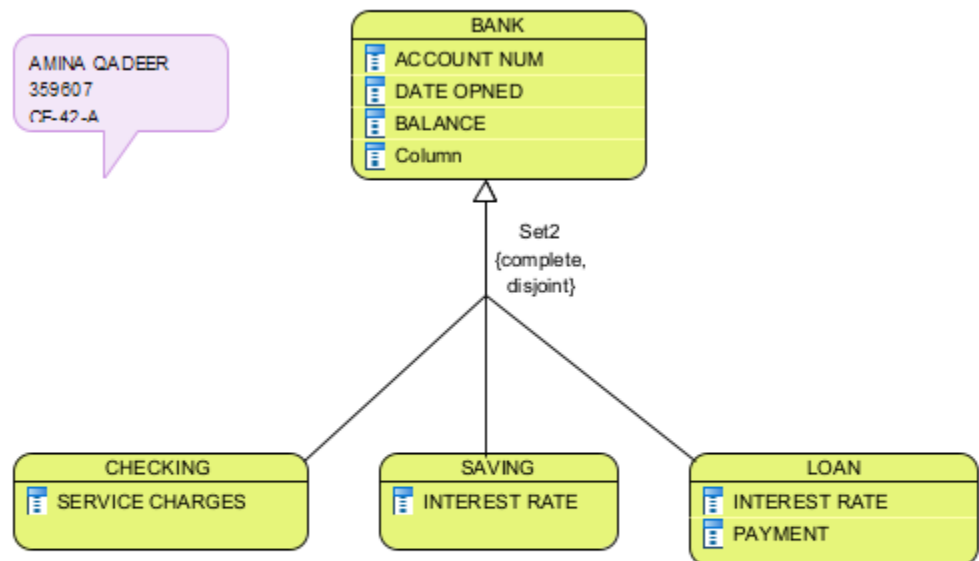
1. Person (with attributes: SSN, Name, Address, City/State/Zip, Telephone)
2. Employee (with attributes: Date Hired)
3. Volunteer (with attributes: Skill)
4. Donor (with relationship named Donates with Item entity type)

The relationships between the entities would be:

1. Person has a one-to-zero-or-one relationship with Employee
2. Person has a one-to-zero-or-one relationship with Volunteer
3. Person has a one-to-many relationship with Donor
4. Item has a one-to-many relationship with Donor

02. Consider the following set of requirements draw an EER diagram.

A bank has three types of accounts: checking, savings, and loan. Following are the attributes for each type of account: CHECKING: Acct No, Date Opened, Balance, Service Charge SAVINGS: Acct No, Date Opened, Balance, Interest Rate LOAN: Acct No, Date Opened, Balance, Interest Rate, Payment Assume that each bank account must be a member of exactly one of these subtypes. Develop an EER model segment to represent this situation. Remember to include a subtype discriminator.



03. Draw an EER diagram.

An international school of technology has hired you to create a database management system to assist in scheduling classes. After several interviews with the president, you have come up with the following list of entities, attributes, and initial business rules:

- Room is identified by Building ID and Room No and also has a Capacity. A room can be either a lab or a classroom. If it is a classroom, it has an additional attribute called Board Type.
- Media is identified by MType ID and has attributes of Media Type and Type Description. Note: Here we are tracking type of media (such as a VCR, projector, etc.), not the individual piece of equipment. Tracking of equipment is outside of the scope of this project.
- Computer is identified by CType ID and has attributes Computer Type, Type Description, Disk Capacity, and Processor Speed. Please note: As with Media Type, we are tracking only the type of computer, not an individual computer. You can think of this as a class of computers (e.g., PIII 900MHZ).
- Instructor has identifier Emp ID and has attributes Name, Rank, and Office Phone.



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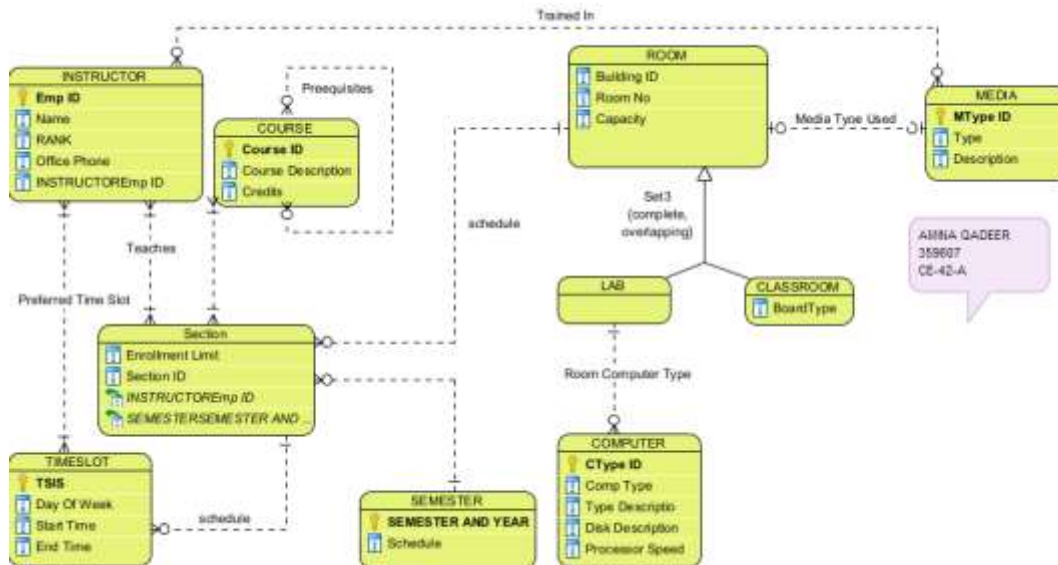


Department of Computer Engineering

- Timeslot has identifier TSIS and has attributes Day Of Week, Start Time, and End Time.
- Course has identifier Course ID and has attributes Course Description and Credits. Courses can have one, none, or many prerequisites. Courses also have one or more sections.
- Section has identifier Section ID and attribute Enrollment Limit.

After some further discussions, you have come up with some additional business rules to help you create the initial design:

- An instructor teaches one, none, or many sections of a course in a given semester.
- An instructor specifies preferred time slots.
- Scheduling data are kept for each semester, uniquely identified by semester and year.
- A room can be scheduled for one section or no section during one time slot in a given semester of a given year. However, one room can participate in many schedules, one schedule, or no schedules; one time slot can participate in many schedules, one schedule, or no schedules; one section can participate in many schedules, one schedule, or no schedules. Hint: Can you associate this to anything that you have seen before?
- A room can have one type of media, several types of media, or no media.
- Instructors are trained to use one, none, or many types of media.
- A lab has one or more computer types. However, a classroom does not have any computers.
- A room cannot be both a classroom and a lab. There also are no other room types to be incorporated into the system.



04. an EERD for the following situation.

TomKat Entertainment is a chain of theaters owned by former husband and wife actors/entertainers who, for some reason, can't get a job performing anymore. The owners want a database to track what is playing or has played on each screen in each theater of their chain at different times of the day. A theater (identified by a Theater ID and described by a theater name and location) contains one or more screens for viewing various movies. Within each theater each screen is identified by its number and is described by the seating capacity for viewing the screen. Movies are scheduled for showing in time slots each day. Each screen can have different time slots on different days (i.e., not all screens in the same theater have movies starting at the same time, and even on different days the same movie may play at different times on the same screen). For each time slot, the owners also want to know the end time of the time slot (assume all slots end on the same day the slot begins), attendance during that time slot, and the price charged for attendance in that time slot. Each movie (which can be either a trailer, feature, or commercial) is identified by a Movie ID and further described by its title, duration, and type (i.e., trailer, feature, or commercial). In each time slot, one or more movies are shown. The owners want to also keep track of in what sequence the movies are shown (e.g., in a time slot there might be two trailers, followed by two commercials, followed by a feature film, and closed with another commercial).

