The Australian National University, School of Computing
COMP2400/6240 (Relational Databases)
Semester 2, 2022

Lab 4, Week 5

ER Modeling (Exercises)

In this week's lab, we will use the Entity-Relationship (ER) modeling approach to conduct the conceptual design for a database application.

1   ER Modeling Question

Consider the following data requirements for a university project database:

- Professors have an SSN, a name, an age, a rank, and a research specialty.

- Projects have a project number, a sponsor name, a starting date, an ending date, and a budget.

- Graduate students have an SSN, a name, an age, and a degree program (M.S. or Ph.D.)

- Each project is managed by one professor (known as the projects principal investigator).

- Each project is worked on by one or more professors (known as the projects co-investigators).

- Professors can manage and/or work on multiple projects.

- Each project is worked on by one or more graduate students (known as the projects research assistants).

- When graduate students work on a project, a professor must supervise their work on the project. Graduate students can work on multiple projects, in which case they will have a (potentially different) supervisor for each one.

- Departments have a department number, name, and a main office.

- Departments have a professor (known as the chairman) who runs the department.

- Professors work in one or more departments, and for each department that they work in, a time percentage is associated with their job.

- Graduate students have one major department in which they are working on their degree.

- Each graduate student may have another (usually more senior) graduate student (known as a student advisor) who advises him or her on what courses to take.

You need to draw an ER diagram to capture the data requirements (if possible) through the following exercises (1)-(5):

(1) *Identify the entity types.*

(2) *Identify the relationship types.*

(3) *Identify the attributes of the entity and relationship types.*

(4) *Identify a primary key for each entity type.*

(5) *Identify cardinality ratios or participation constraints, if any.*

You also need to state the necessary assumptions, if any, to make your modelling solutions complete.

2 Design Choice Questions

The following questions relate to several important design choices you may often come across when designing an ER model.

2.1 Entity versus Attribute

(6) *Consider the database application described in Section 1. Suppose that we want to record addresses of graduate students. One graduate student may have* more than one *address. We also want to capture* the structure of an address *in terms of city, state, country, and postcode. In this case, should the concept address be modeled as an attribute or an entity?*

2.2   Entity versus Relationship

(**7**) *Consider the database application described in Section 1. Suppose that we want to further model the information about a discretionary budget given to professors who manage projects. How would you model this in the following two different cases?*

- Case 1: Suppose that each professor is given a discretionary budget for *each* project managed by him or her, and the budgets may vary in different projects for the same professor.

- Case 2: Suppose that each professor is given a discretionary budget for *all* projects managed by him or her, regardless of how many projects the professor manages.
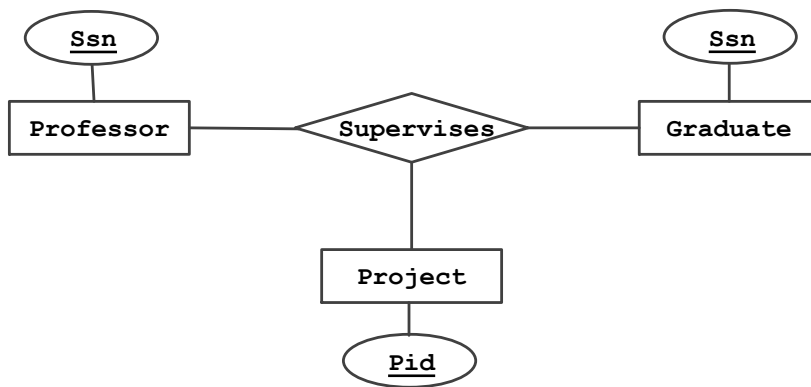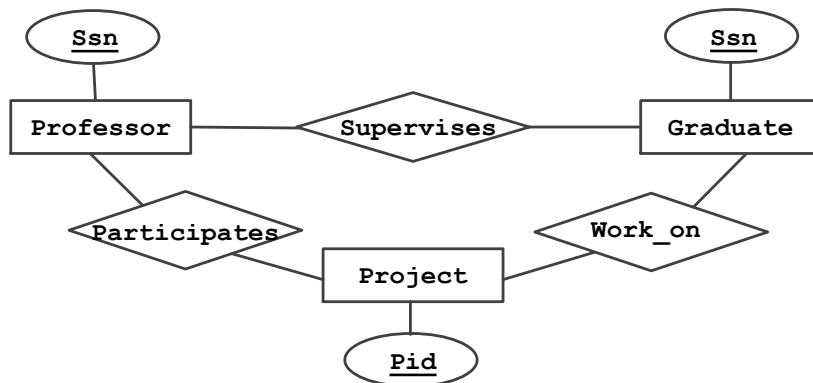

Figure 2: Ternary relationship

Figure 3: Binary relationship

2.3 Binary versus Ternary Relationships

(8) *Consider the database application described in Section 1, and two ER models presented in Figure 2 and Figure 3. For the relationships between professors, projects and graduate students, which of the ER models do you prefer to choose? Explain the difference between the data requirements captured by these two ER models.*