

# Database Lab

CSE 3104

**Session 04**

## 4 ERD

### Why ERDs?

Entity Relationship Diagrams are a major data modeling tool and will help organize the data in your project into entities and define the relationships between the entities. This process has proved to enable the analyst to produce a good database structure so that the data can be stored and retrieved in a most efficient manner. By using a graphical format it may help communication about the design between the designer and the user and the designer and the people who will implement it.

### 4.1 Components of ERD

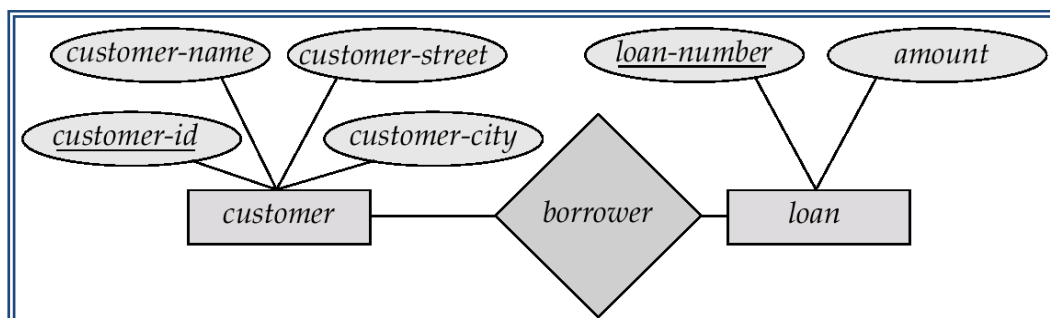
An ERD typically consists of four different graphical components:

- **Entity. (Nouns)**

A data entity is anything real or abstract about which we want to store data. Entity types fall into five classes: roles, events, locations, tangible things or concepts. E.g. employee, payment, campus, book. Specific examples of an entity are called **instances**. E.g. the employee Karim Rahman, Hashim Khan's payment, etc.

- **Relationship. (Verb)**

A data relationship is a natural association that exists between one or more entities. E.g. Abdul ***borrow***s Loan-1.

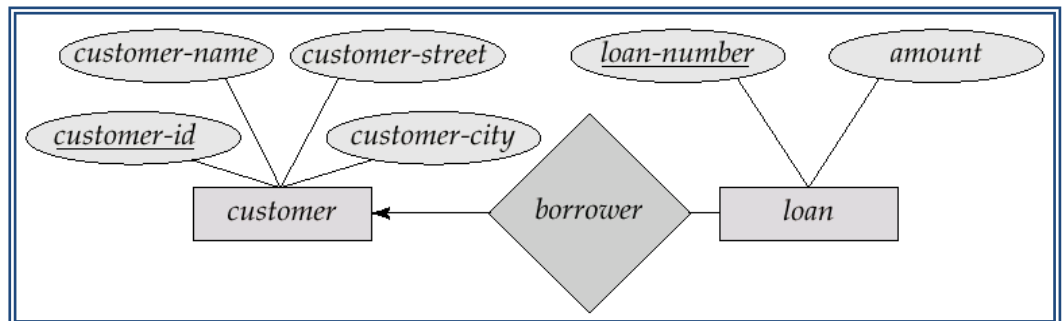


## • Cardinality. (Adverbs)

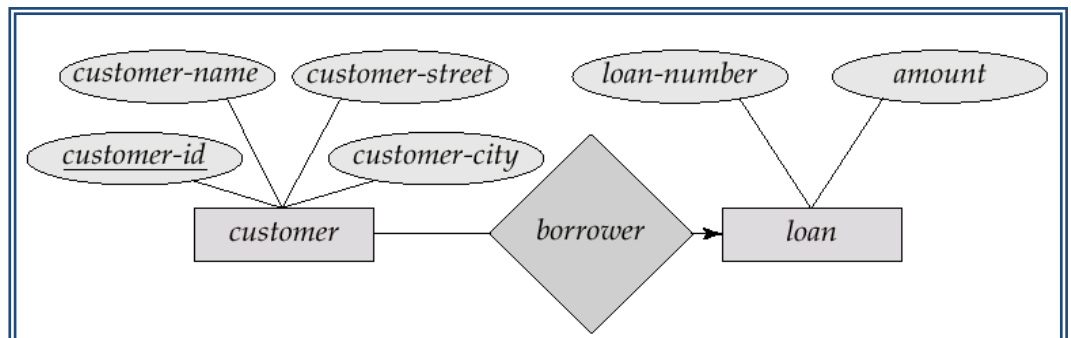
Defines the numerical attributes of the relationship between two entities or entity sets.

Different types of cardinal relationships are:

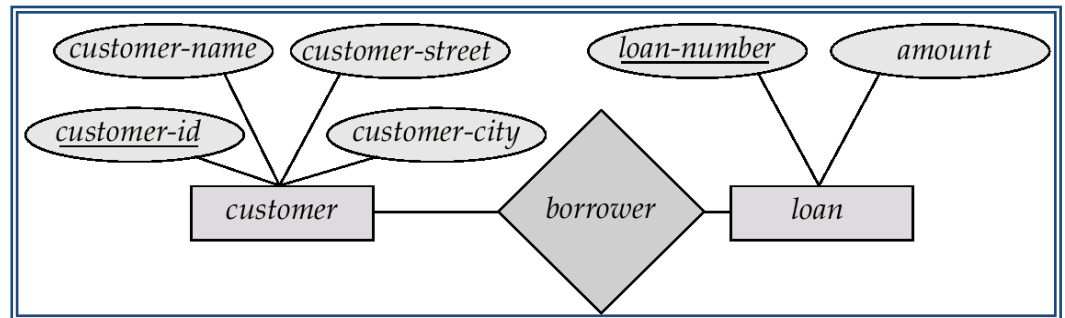
- **One-to-One Relationships:** A customer is associated with at most one loan via the relationship *borrower*. A loan is associated with at most one customer via *borrower*
- **One-to-Many Relationships:** In the one-to-many relationship a loan is associated with at most one customer via *borrower*, a customer is associated with several (including 0) loans via *borrower*



- **May to One Relationships:** In a many-to-one relationship a loan is associated with several (including 0) customers via *borrower*, a customer is associated with at most one loan via *borrower*



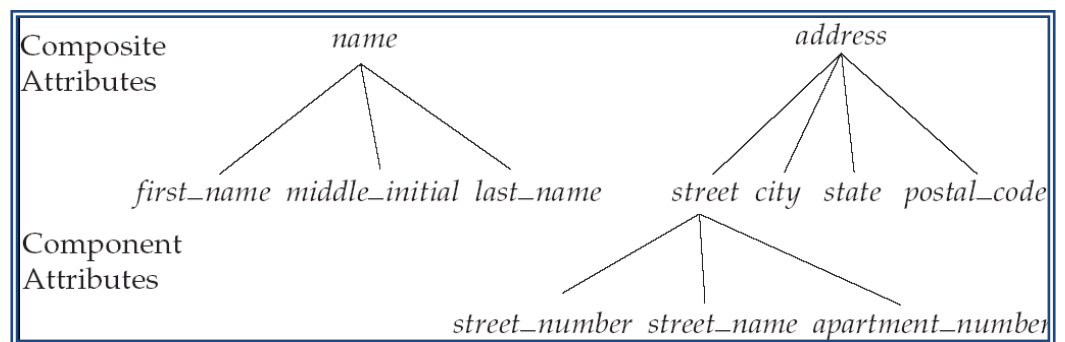
- **Many-to-Many Relationships:** A customer is associated with several (possibly 0) loans via borrower. A loan is associated with several (possibly 0) customers via borrower



## • Attribute. (Adjective , But they are often Nouns)

It is a single-valued property of either an entity-type or a relationship-type.

### ✦ Simple and composite attributes.

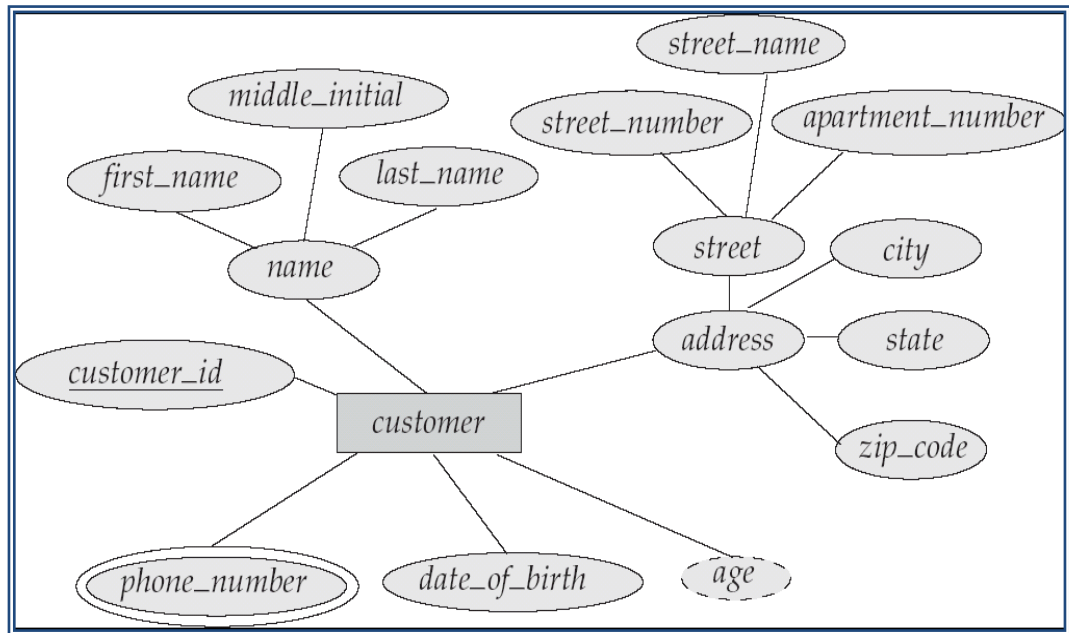


### ✦ Single-valued and multi-valued attributes

- Example: single valued: age, multivalued attribute: *phone\_numbers*(one may have multiple phone no)

✧ **Derived attributes**

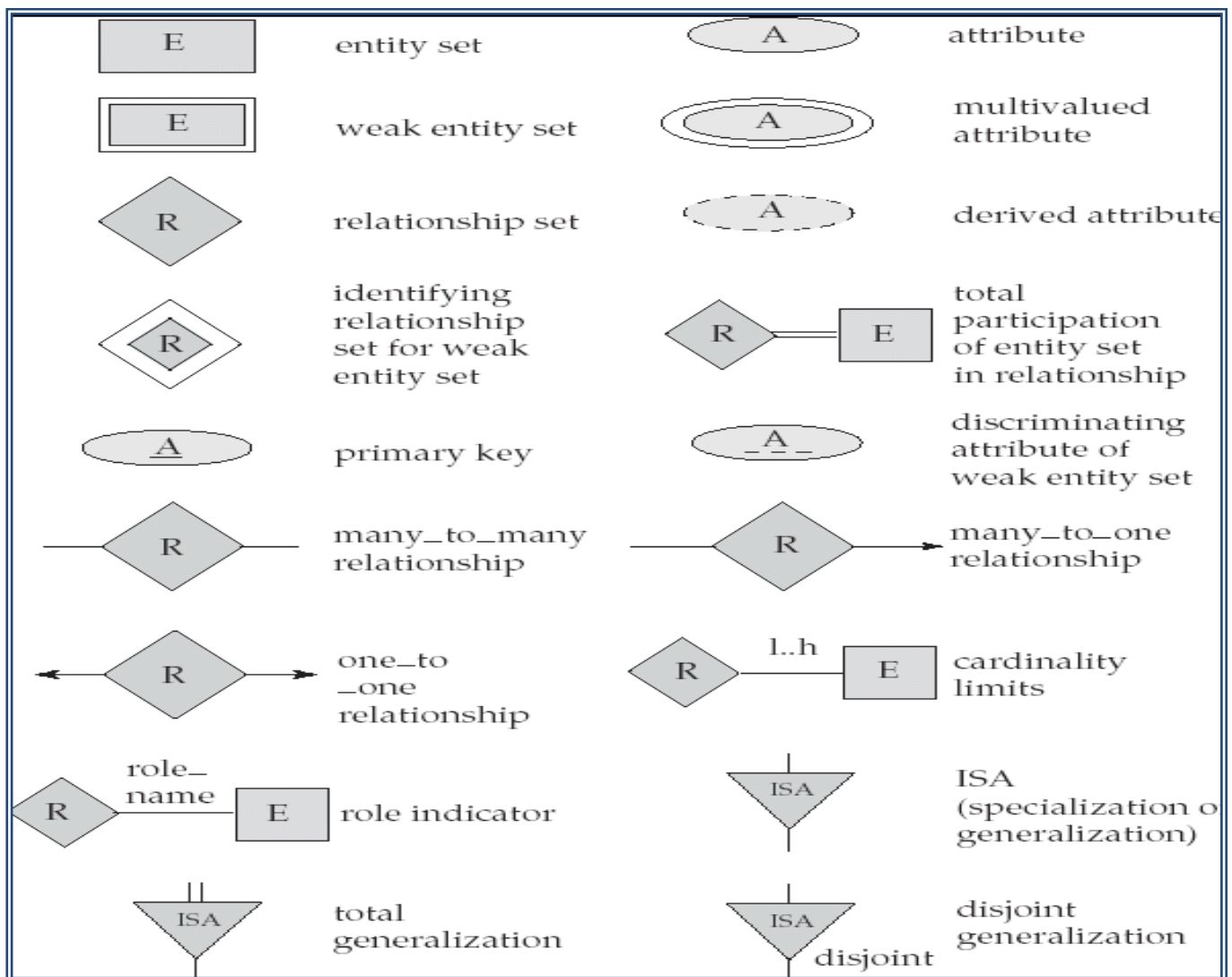
- Can be computed from other attributes
- Example: age, given date\_of\_birth



## 4.1 Notations or Symbols for drawing ERD

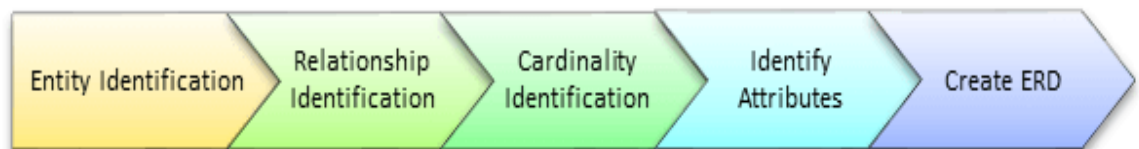
Rectangles represent entity sets.

- Diamonds represent relationship sets.
- Lines link attributes to entity sets and entity sets to relationship sets.
- Ellipses represent attributes
  - Double ellipses represent multivalued attributes.
  - Dashed ellipses denote derived attributes.
- Underline indicates primary key attributes



## 4.2 One Methodology for Developing an ERD

Now in this ERD Diagram Tutorial, we will learn how to create an ER Diagram. Following are the steps to create an ER Diagram:



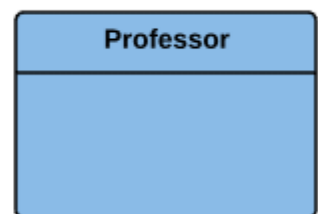
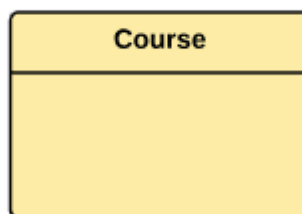
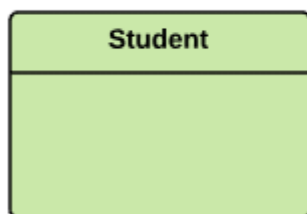
Let's study them with an Entity Relationship Diagram Example:

In a university, a Student enrolls in Courses. A student must be assigned to at least one or more Courses. Each course is taught by a single Professor. To maintain instruction quality, a Professor can deliver only one course

### Step 1) Entity Identification

We have three entities

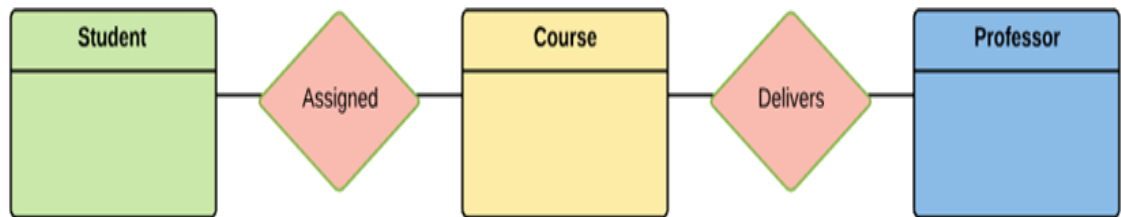
- Student
- Course
- Professor



## Step 2) Relationship Identification

We have the following two relationships

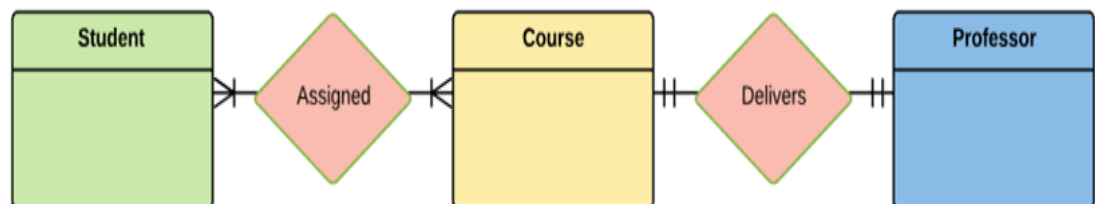
- The student is **assigned** a course
- Professor **delivers** a course



## Step 3) Cardinality Identification

For them problem statement we know that,

- A student can be assigned **multiple** courses and a course can be assigned to **multiple** students
- A Professor can deliver only **one** course and a single course is taught by only **one** Professor.



## Step 4) Identify Attributes

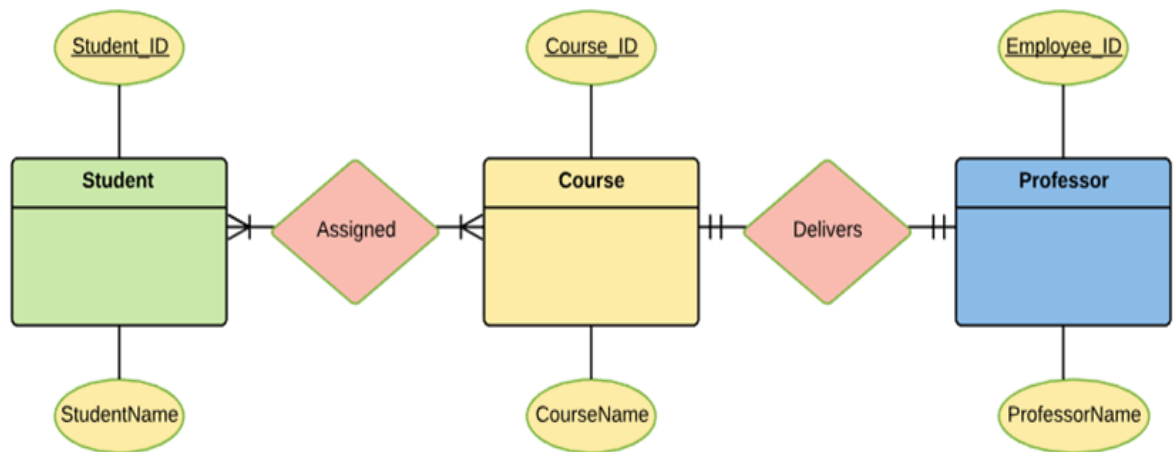
You need to study the files, forms, reports, data currently maintained by the organization to identify attributes. You can also conduct interviews with various stakeholders to identify entities. Initially, it's important to identify the attributes without mapping them to a particular entity.

Once, you have a list of Attributes, you need to map them to the identified entities. Ensure an attribute is to be paired with exactly one entity. If you think an



attribute should belong to more than one entity, use a modifier to make it unique.  
 Once the mapping is done, identify the primary Keys. If a unique key is not readily available, create one

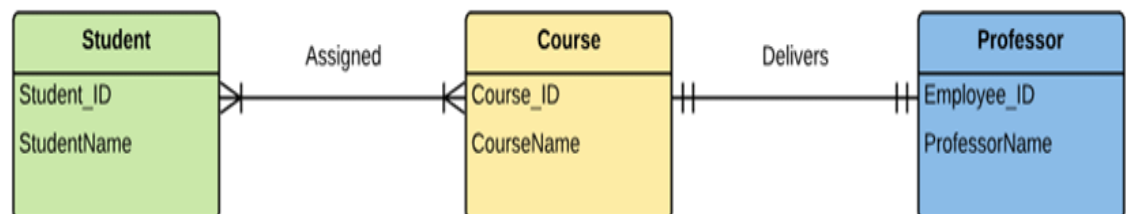
Entity	Primary Key	Attribute
Student	Student_ID	StudentName
Professor	Employee_ID	ProfessorName
Course	Course_ID	CourseName



For Course Entity, attributes could be Duration, Credits, Assignments, etc. For the sake of ease we have considered just one attribute.

## Step 5) Create the ERD Diagram

A more modern representation of Entity Relationship Diagram Example



## E-R Diagram with a Ternary Relationship:

- Example: Suppose employees of a bank may have jobs (responsibilities) at multiple branches, with different jobs at different branches. Then there is a ternary relationship set between entity sets employee, job, and branch

