# From E-R Model to Relational Database Model

Hui Chen [a]
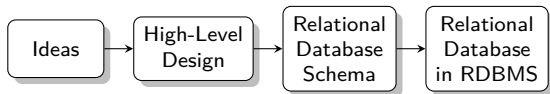
[a]CUNY Brooklyn College, Brooklyn, NY, USA

February 22, 2022

# Outline

# Overview

```
┌────────┐     ┌────────────┐     ┌────────────┐     ┌────────────┐
│        │     │            │     │ Relational │     │ Relational │
│ Ideas  │ ──▶ │ High-Level │ ──▶ │  Database  │ ──▶ │  Database  │
│        │     │   Design   │     │   Schema   │     │  in RDBMS  │
└────────┘     └────────────┘     └────────────┘     └────────────┘
```

# Outline

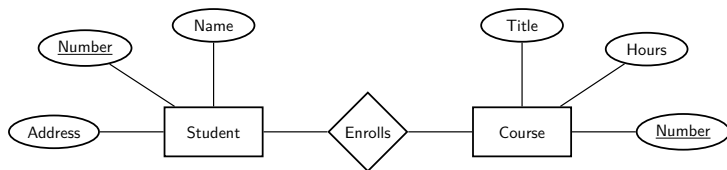# E-R Diagram $\rightarrow$ Relational Schema

Basic idea.

- ▶ An entity set $\rightarrow$ a relation (with the same set of attributes)
- ▶ A relationship $\rightarrow$ a relation (whose attributes are the keys for the connected entity sets)
- ▶ Special treatment for
    - ▶ Sometimes, we do well to combine two relations
    - ▶ Weak entity sets cannot be translated straightforwardly to relations
    - ▶ "Isa" relationships and subclasses require careful treatment.
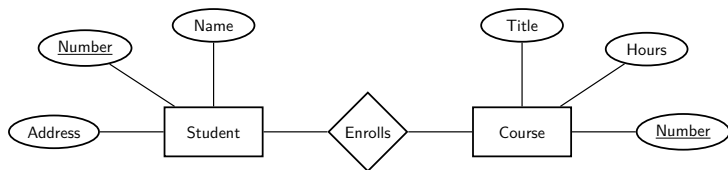
# Outline

# E-R Entity Sets to Relations

Turn an entity set to a relation with the same set attributes and key constraints.

# E-R Entity Sets to Relations

Turn an entity set to a relation with the same set attributes and key constraints.
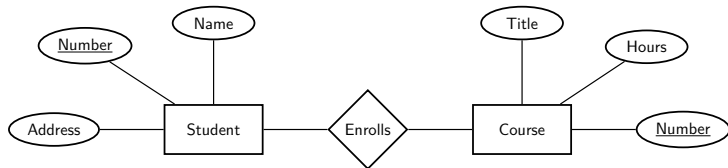


Relational Database Schema:

```
Student(sname, snum, saddr)
```
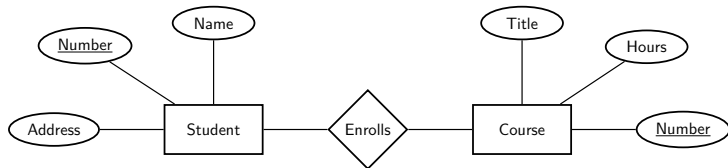
# Outline

# E-R Relationship to Relations

Turn a relationship to a relation whose attributes are the keys for the connected entity set

# E-R Relationship to Relations

Turn a relationship to a relation whose attributes are the keys for the connected entity set



Relational Database Schema:

```
Enrollment(stu_number, course_num)
```

# Outline

1. E-R Model to Relational Schemas

2. E-R Entity Set to Relation

3. E-R Relationship to Relation

4. **Combining Entity Sets**

5. Handling Weak Entity Sets

6. Handling ISA Relationships

7. Assignment

# Combining Entity Sets

Sometimes, we do well to combine two relations (an entity set and a relation) to form one relation

- ▶ There is an entity set E with a many-one relationship R from E to F. Often better to combine E and R to form a relation with
  - ▶ All attributes of E.
  - ▶ The key attributes of F.
  - ▶ Any attributes belonging to relationship R.
- ▶ Example. Customers make sales transaction; Studios own movies ...

Question. Is it a good idea to combine relations when they are associated in a many-to-many relationship?

# Outline

# Handling Weak Entity Sets

Given W is a weak entity set,

▶ Construct for W a relation whose schema consists of:
  ▶ All attributes of W.
  ▶ All attributes of supporting relationships for W.
  ▶ For each supporting relationship for W, say a many-one relationship from W to entity set E, all the key attributes of E. (Rename attributes, if necessary, to avoid name conflicts.)

▶ Do not construct a relation for any supporting relationship for W.

Examples. Basketball player and teams; Studios and crews.

# Outline

# Converting Subclass Structures to Relations

Generally, there are three approaches, each has advantages and disadvantages.

- ▶ Straight-E/R.
- ▶ Object-oriented.
- ▶ nulls.

# Straight-E/R

Follow the E/R viewpoint – for each entity set E in the hierarchy, create a relation that includes the key attributes from the root and any attributes belonging to E.

Let's consider entity sets `People`, `Students`, `Master's Student`, and `PhD Students`.

# Object-Oriented

Treat entities as objects belonging to a single class – for each possible subtree that includes the root, create one relation, whose schema includes all the attributes of all the entity sets in the subtree

Let's consider entity sets `People`, `Students`, `Master's Student`, and `PhD Students`.

# Using nulls

Use null values. Create one relation with all the attributes of all the entity sets in the hierarchy. Each entity is represented by one tuple, and that tuple has a null value for whatever attributes the entity does not have.

Let's consider entity sets `People`, `Students`, `Master's Student`, and `PhD Students`.

## Comparison

Consider:

- ▶ Easy or difficult to answer certain queries
- ▶ Different number of relations
- ▶ Amount of storage spaces

# Outline

# Assignment

Let's work on some exercises ...