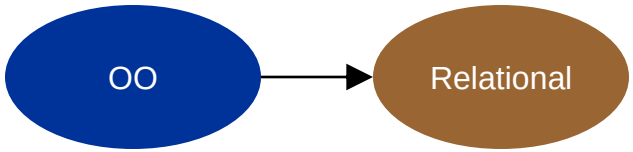
OO → Relational Mapping



Ref: Papers titled “Relational database design using object-oriented methodology” and “An object-oriented relational database.”

Database Design Overview

- Start with OO Schema Design
- Use Object-Relational Mapping to come up with relational database design
  - OR mapping is used for storing object data in relational databases
  - OR mapping rules are similar to ER mapping rules

OO Schema Design

DB 101 Data Management

Hands on – Problem Statement

The student information system maintains details regarding the courses the students take. The courses may have some pre-requisites that specify a specific skill and the experience in that skill (e.g., 2 years in C++). The students letter grade is captured for each course they have enrolled in. The students are allowed to work on campus as teaching assistant for a course or just as research assistants. Faculty members are expected to teach about 5 courses overall. They cannot co-teach a course with other faculty members.

Hands on – Note the nouns

The **student information system** maintains details regarding the **courses** the **students** take. The courses may have some **pre-requisites** that specify a specific **skill** and the **experience** in that skill (e.g., 2 years in C++). The students **letter grade** is captured for each course they have enrolled in. The students are allowed to work on **campus** as **teaching assistant** for a course or just as **research assistants**. **Faculty members** are expected to teach about 5 courses overall. They cannot co-teach a course with other faculty members.

Hands on – Now the verb phrases

The **student information system** **maintains** details regarding the **courses** the **students** take. The courses may **specify** some **pre-requisites** in the form of **skill** and the **experience** in that skill (e.g., 2 years in C++). The students **letter grade** is captured for each course they **have enrolled in**. The students are allowed to **work** on **campus** as **teaching assistant** for a course or just as **research assistants**. **Faculty members** are expected to **teach** about 5 courses overall. They cannot co-teach a course with other faculty members.

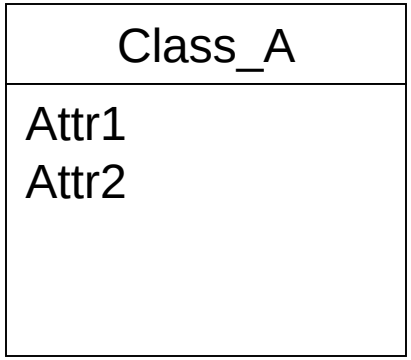
OO Schema Design

- Noun phrases are potential classes
- Noun phrases are potential attributes
- Verb phrases are potential relationships
- Analyze the requirements to
  - Separate classes and attributes from noun phrases
  - Identify association, aggregation, composition and inheritance from the verb phrases

Mapping

Class

1. Create a table Table_A
2. Include all the attributes of the class Class_A as columns of the table table_A.
3. Add a surrogate key to Table_A.
4. Add semantic constraints to the Table_A (unique key, NOT NULL, value constraints, etc.)



Association

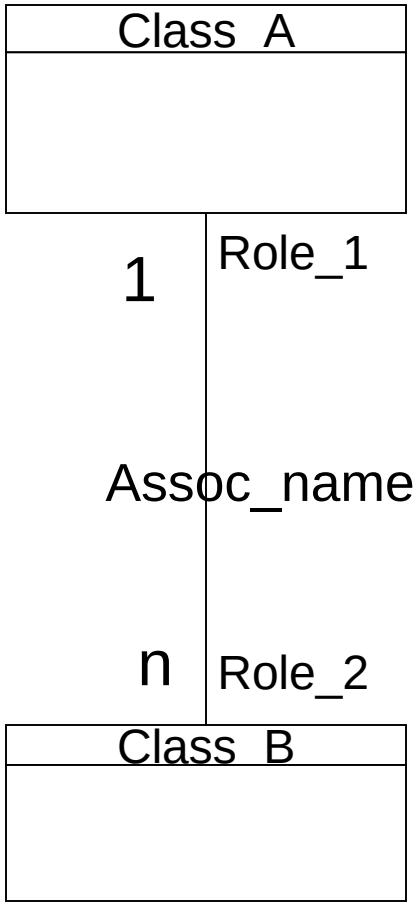
- Possible cardinalities
  - 1:N (or N:1)
  - M:N (or N:M)
  - 1:0..1 (or 0..1:1)
  - 1:1

1:N Association

1. Add the surrogate key of Table_A as foreign key in Table_B.
2. The name of the foreign key should be the name of the role.
3. Add a NOT NULL constraint to the foreign key

Why?

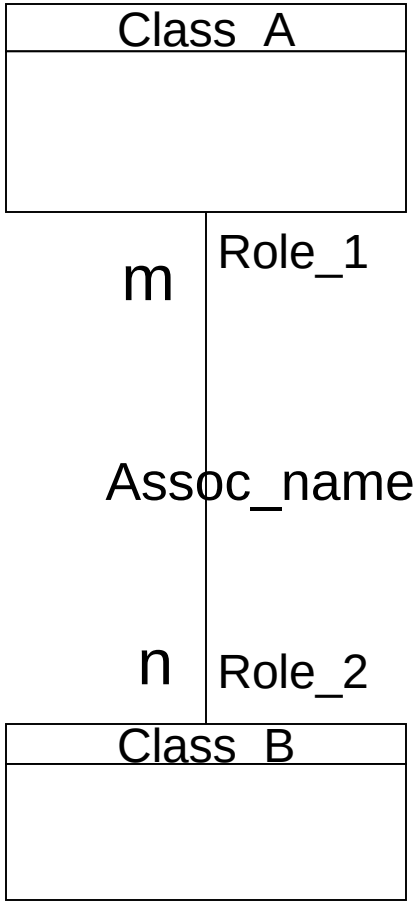
N:1 is same as above but in reverse



What changes should we do make for 0..1:N?

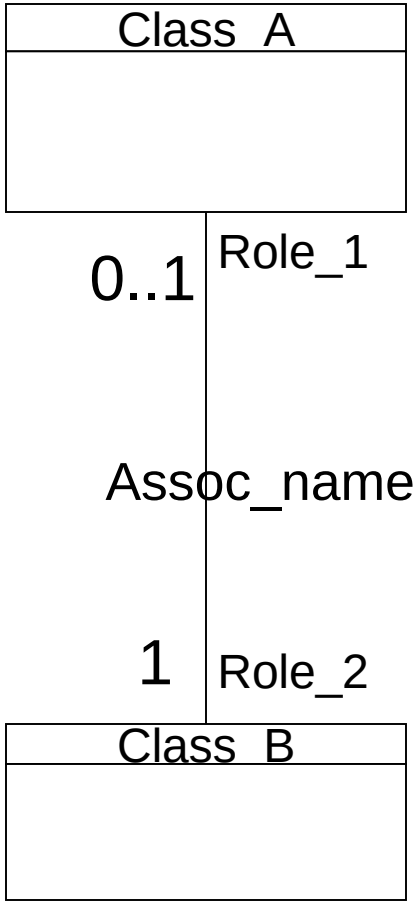
M:N Association

1. Create a new table Table_C having the same name as the association name.
2. Add a surrogate key to Table_C
3. Add any association attributes that may be present as columns of Table_C
4. (Optional) Add the surrogate keys of Table_A and Table_B as composite key of the new table.



0..1 : 1 Association

1. Add the surrogate key of Table_A as foreign key in Table_B.
2. The name of the foreign key should be the name of the role.
3. Allow NULL values to the foreign key

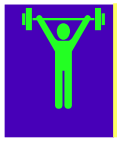


1:0..1 is same as above but in reverse

These rules are similar to the N:1 rules for N = 1

1:1 Association

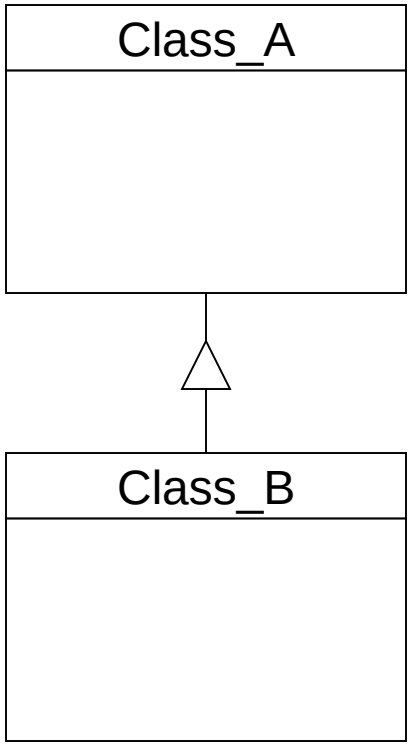
- We cannot map 1:1 association to the relational model!
- We have to either convert it to 1:0..1 or 0..1:1



Find out and report why 1:1 relationship cannot be modelled in the relational data model

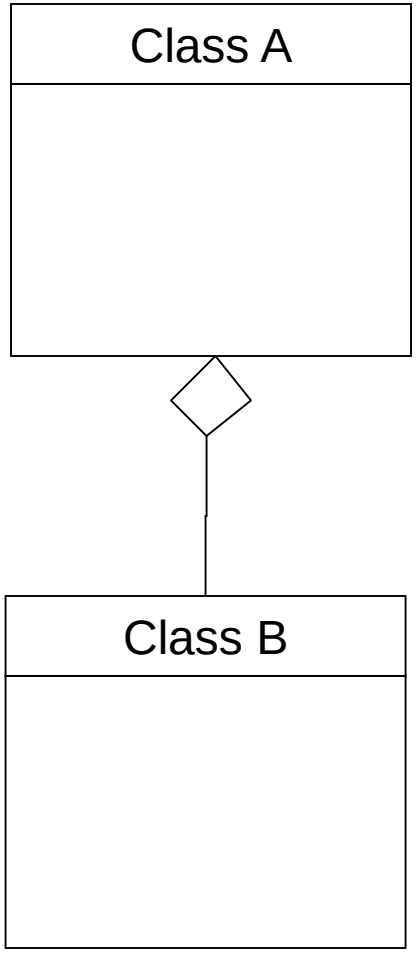
Inheritance

1. Make the surrogate key of Table_B both into a primary key and into a foreign key that references Table_A.
2. Add a discriminant attribute to Table_A to indicate the name of the subclass to which a given instance belongs



Aggregation

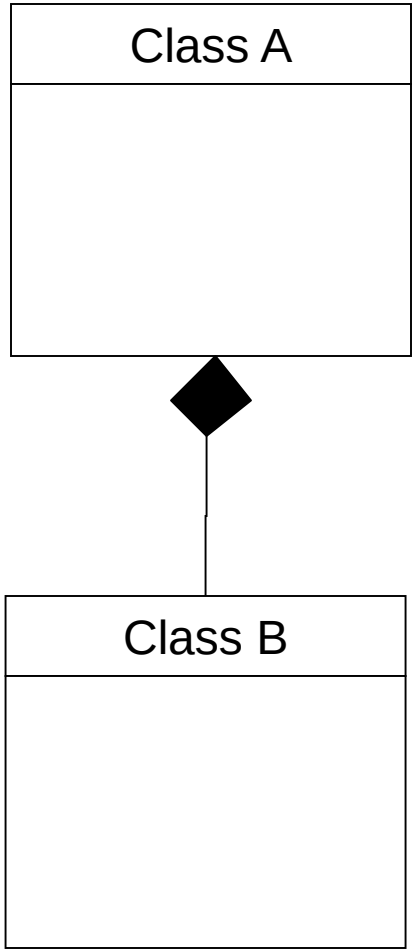
1. Add the surrogate key of Table_A as foreign key in Table_B.
2. Add a NULL constraint on the foreign key



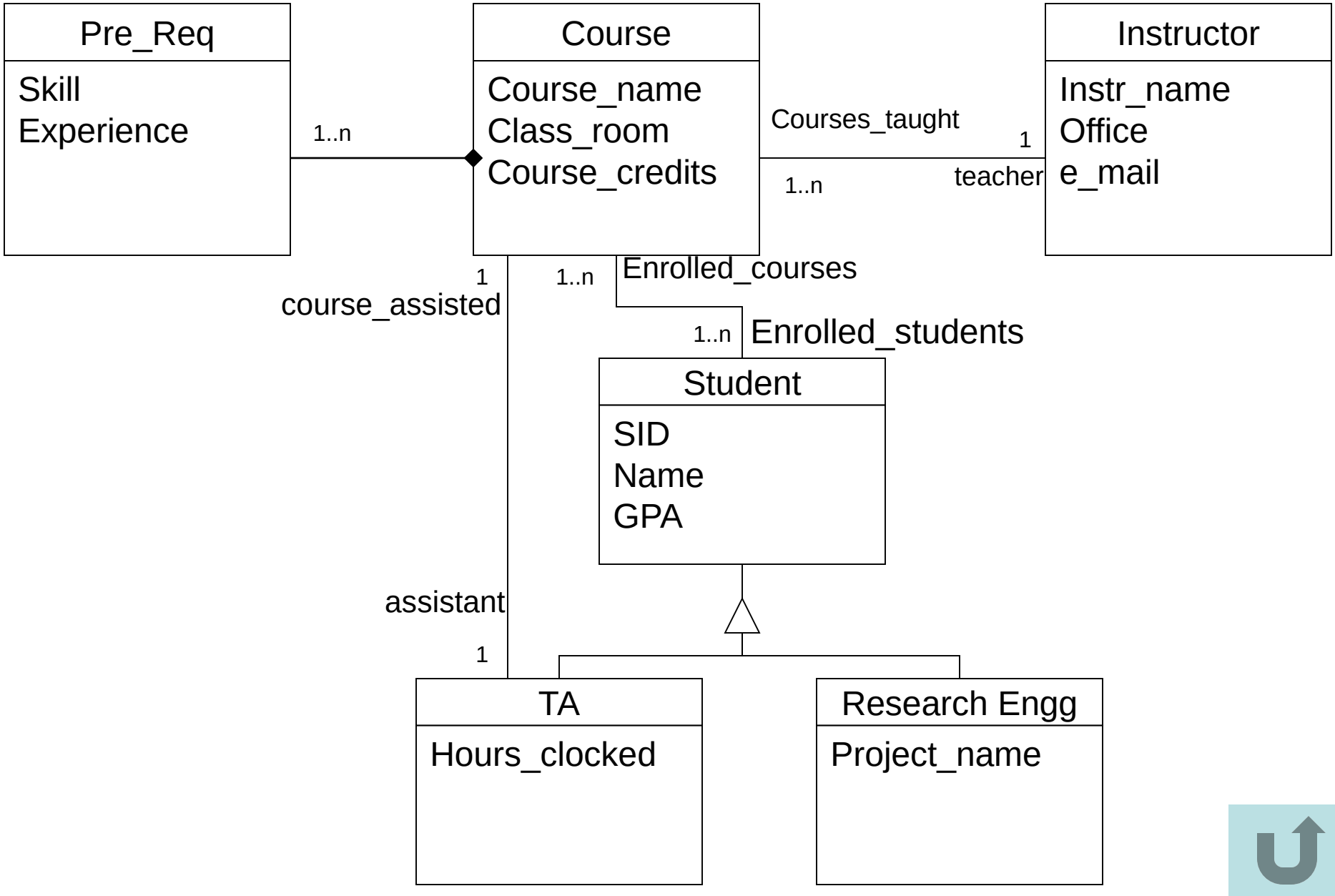
These rules are same as 1:N association between whole and part

Composition

1. Add the surrogate key of Table_A as foreign key in Table_B.
2. Add a NOT NULL constraint on the foreign key
3. Add ON DELETE CASCADE constraint on the foreign key



Hands on – OO Schema



Hands-on: A possible solution

COURSE					
ID_PK	Course_Name	Class_Room	Course_Credits	**Instr_ID_FK**	**Assisted_by_FK**

PRE_REQ			
ID_PK	Skill	Experience	**Crs_ID_FK**

RESEARCH_ENGG		
ID_PK	**Student_ID_FK**	Project_Name

INSTRUCTOR			
ID_PK	Instr_Name	Office	e_mail

TEACHING_ASST	
ID_PK	**Student_ID_FK**

STUDENT				
ID_PK	SID	Name	GPA	Student_Type

COURSE_STUDENT		
ID_PK	**Crs_ID_FK**	**Student_ID_FK**