UML Data Modelling

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Based on Jennifer Widom slides

Agenda

Introduction to Database Design

Classes

Associations

Association Classes

Generalizations

Composition & Aggregation

Constraints

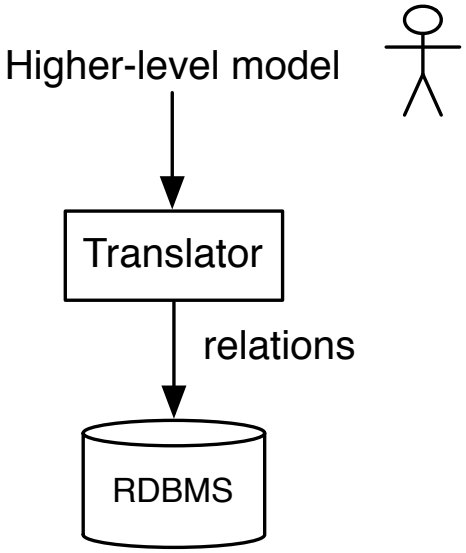
Derived Elements

Data modelling

How to represent data for application

Database design model

- Not implemented by system
- Translated into model of DBMS



Higher-Level Database Design Models

Entity-Relationship Model (E/R)

Unified Modeling Language (UML)

- Data modeling subset

Both are graphical

Both can be translated to relations automatically

- Or semi-automatically

Key concepts

Classes

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Classes

Descriptor of a set of objects that share the same properties (semantics, attributes, and relationships)

Concrete things

- person, book, car, …

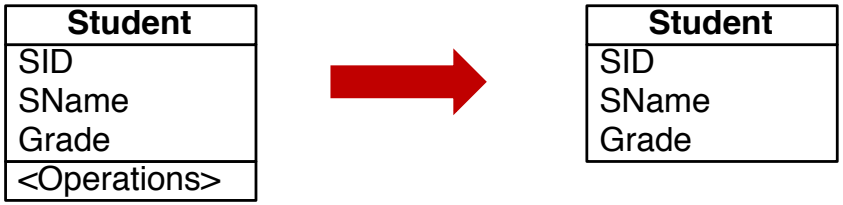
Conceptual things

- class, course, profession, …

Classes

Characterized by name, attributes and operations

For data modeling: drop operations



The class name is usually written in the singular, with the first letter in uppercase

Attributes

Attributes are defined in terms of class, while values of the attributes are defined at the instance level

- A student has the attributes: identifier, name and admission grade
- John is a student with the id *123*, name *John Smith* and an admission grade of *180*

A class should not have two attributes with the same name

Attributes can be associated with types

- Not predefined in UML
- Use the ones of the DBMS

Student
SID: integer
SName: string
Grade: integer

In data modelling, we can also specify a primary key

Student
SID pk
SName
Grade

Exercise

Imagine the SIGARRA database.

List 3 classes with attributes that might be in this database.

Key concepts

~~Classes~~

Associations

Association Classes

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Associations

Relationships between objects of two classes

As an object is an instance of a class, a **link** is an instance of an association

The name is optional

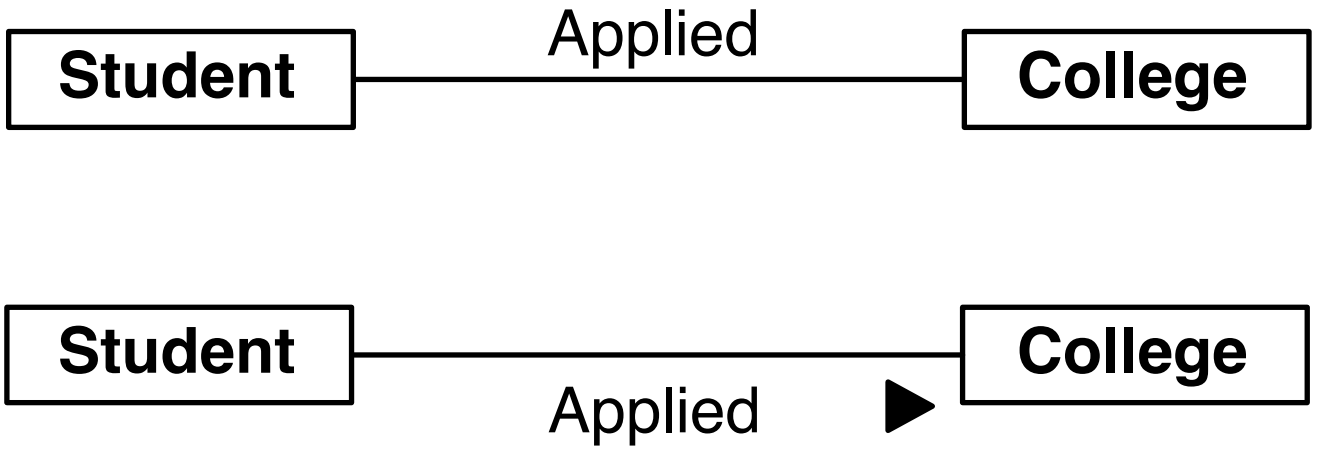
There may be more than one association between the same pair of classes

- Having different names

Associations

Imagine a scenario where students apply to colleges.

What classes would we create? And associations?



Multiplicity of Associations

Each object of Class 1 is related to at least *m* and at most *n* objects of Class 2

A * in place of *n* stands for *no upper limit*

Abbreviations

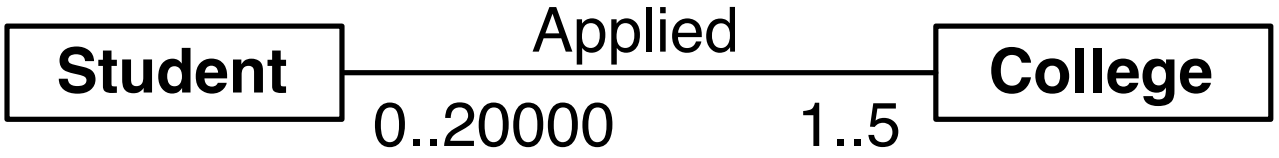
* stands for 0..*, that is, no restrictions

1 stands for 1..1

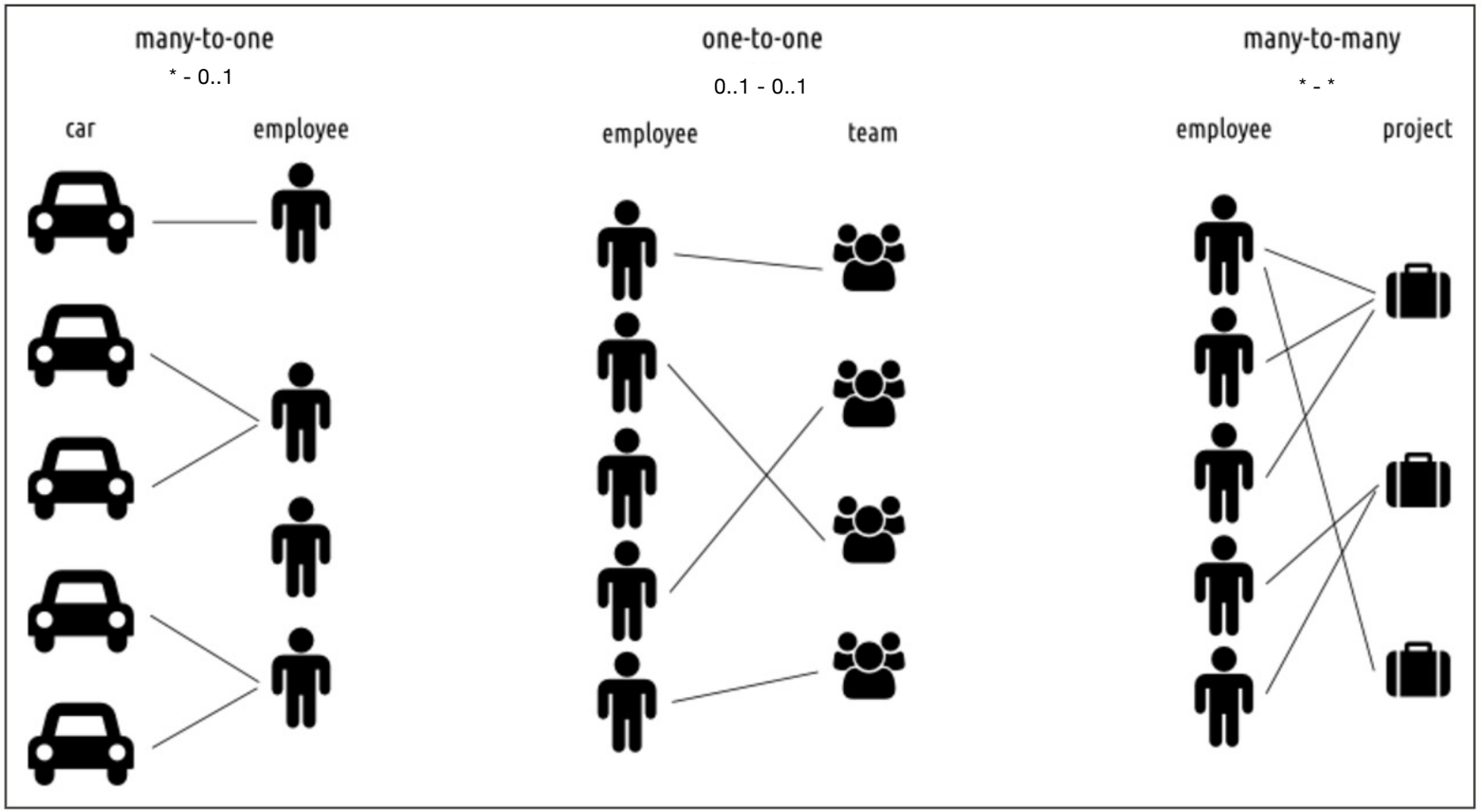
Default: 1..1

Multiplicity of Associations

Students must apply somewhere and may not apply to more than 5 colleges. No college takes more than 20,000 applications.



Multiplicity of Associations



Credits: André Restivo

Complete Associations

Every object must participate in the association

Complete many-to-one

- 1..* - 1..1

Complete one-to-one

- 1..1 – 1..1
- Default association

Complete many-to-many

- 1..* - 1..*

Kahoot time

Any doubts?

Readings

Jeffrey Ullman, Jennifer Widom, A first course in Database Systems 3rd Edition

Section 4.7 - Unified Modeling Language