CSIT882 Data Management Systems

Physical vs Catalog Classes
Object Metamodeling

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Disclaimer: subject materials are sourced from previous offerings of CSIT882

Outline

Physical vs Catalog Classes

- Physical Classes
- Catalog Classes
- Correctness

Object Metamodeling

- Generic classes
- Generic associations
- Metamodel

Basic Concepts

A physical class is a class whose objects are dedicated to at most one assembly

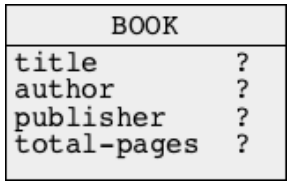
A catalog class is a class whose objects play a role of templates for the objects from the respective physical class

A catalog class is a description of a respective physical class

A catalog class is a class whose objects are reusable across multiple assemblies

Basic Concepts

What is an identifier of a class `BOOK` ?



What about the ISBN (International Standard Book Number) ?

ISBN is 10- or 13-digit number used for identification

ISBN is unique to every book, but ... ... two identical books in a library have the same ISBN !

Is really ISBN an identifier of a class `BOOK` ?

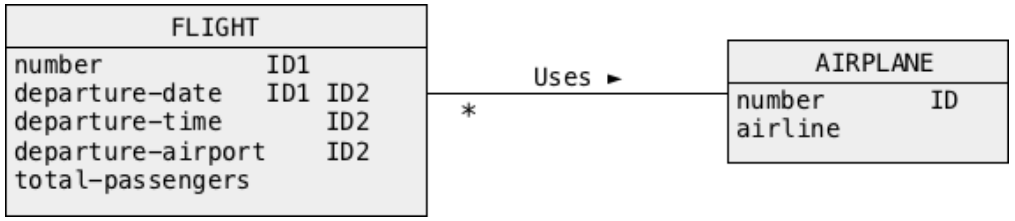
What about library catalog number also called as `call number` ?

The books listed on Amazon do not have `call number` ! Hmmm ..

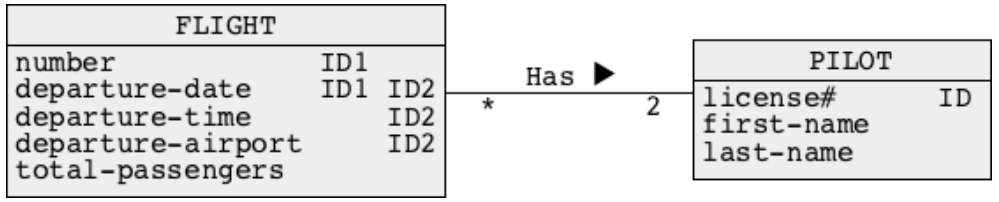
A class `BOOK` is different from a class `BOOK COPY`

Sample Physical Classes

Flights use airplanes



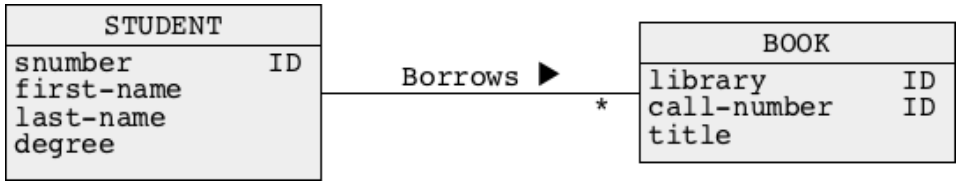
Flights have pilots



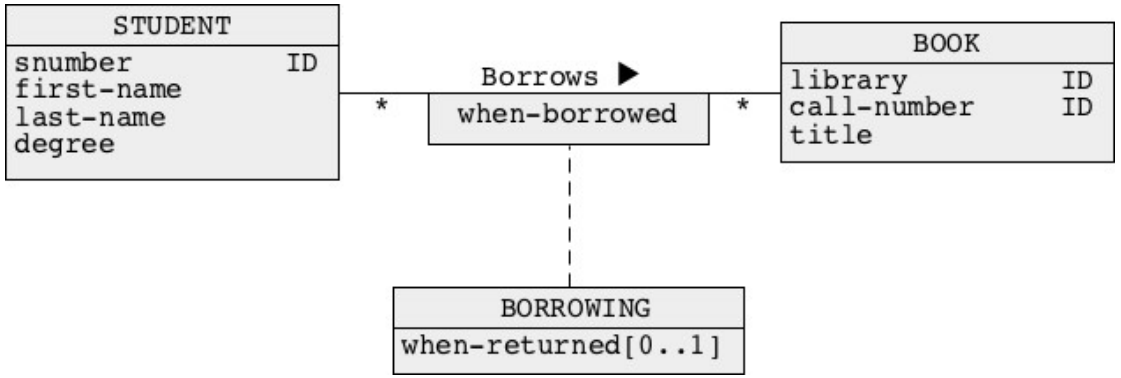
The classes `FLIGHT AIRPLANE PILOT` are physical classes

Sample Physical Classes

Students borrow books



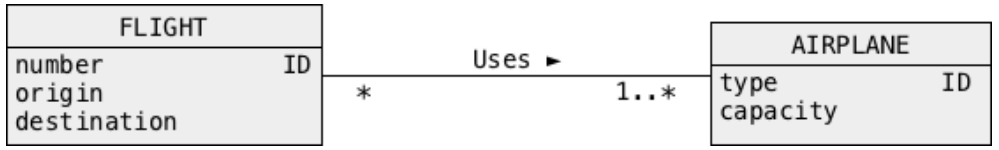
Students borrow books many times



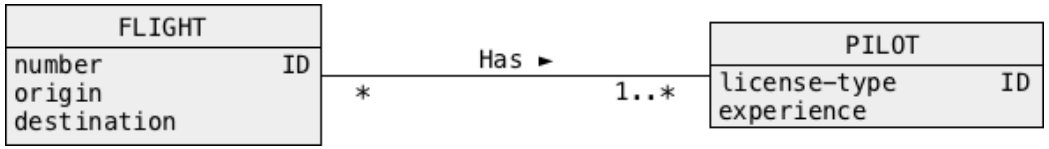
The classes `STUDENT` `BOOK` `BORROWING` are physical classes

Sample Catalog Classes

Flights use airplanes



Flights have pilots

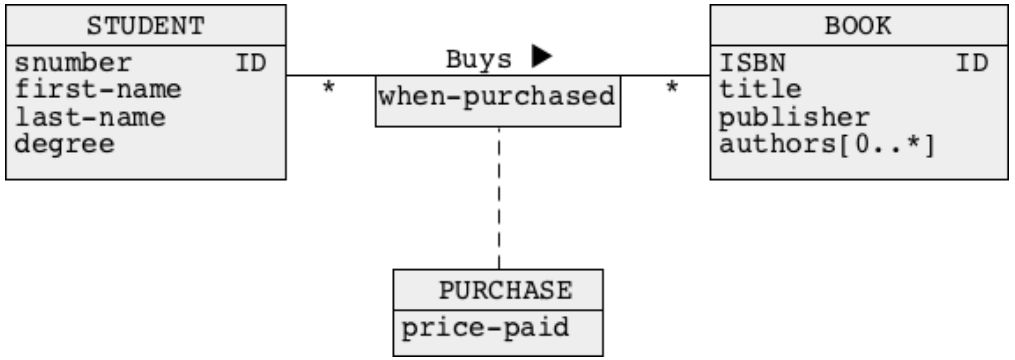


The classes `FLIGHT AIRPLANE PILOT` are catalog classes

Sample Catalog Classes

Students buy books

Students buy books many times



A class BOOK is a catalog class

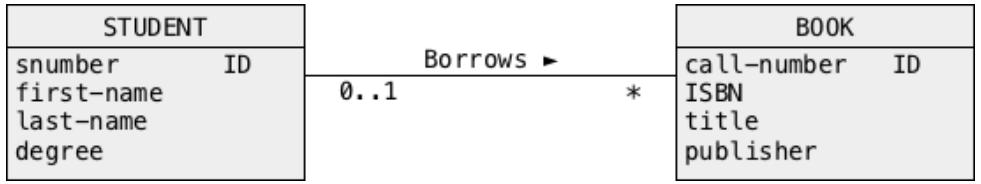
Physical versus Catalog Classes

PHYSICAL CLASSES	CATALOG CLASSES
BOOK-COPY	BOOK
ROOM	ROOM-TYPE
FLIGHT-INSTANCE	FLIGHT
RUNNING SUBJECT	SUBJECT
ASSIGNMENT	ASSIGNMENT-SPECIFICATION
KEYBOARD	KEYBOARD-BLUEPRINT

Correctness

Students buy books

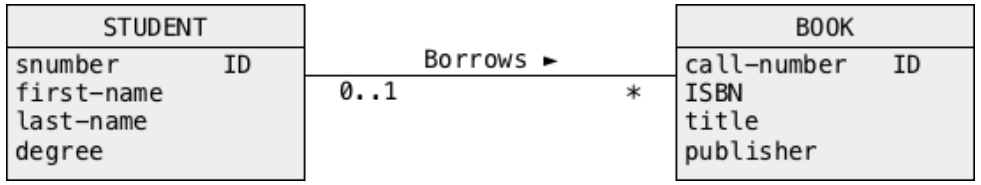
Students borrow books



Which one of the designs above is correct ?

Correctness

A design below is incorrect !



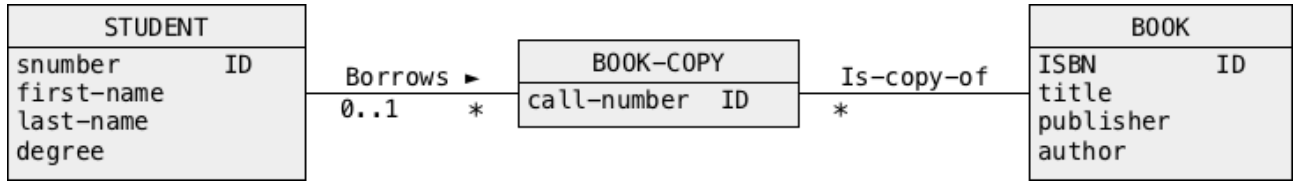
A class `BOOK` is a physical class

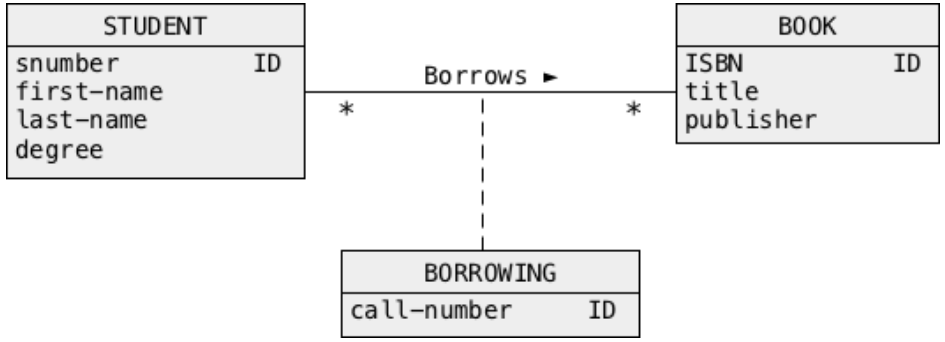
If a class `BOOK` is physical then the copies of books with the same `ISBN` have `title` and `publisher` repeated as many times as many copies of the same book are in a library

It means that information about `title` and `publisher` is redundant for the books that have multiple copies

Correctness

Students borrow copies of books





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Object Metamodeling

- Generic classes
- Generic associations
- Metamodel

Generic classes

Is it possible to design a class in a conceptual schema such that it can be extended with the new attributes without changing anything in a specification of the class ?

A generic class of objects allows for unlimited extension of the class with the new attributes without changing anything in a specification of the class

A generic class of objects is a class that combines data and metadata

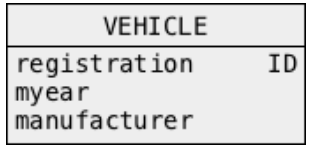
Metadata contains information about the names of attributes used in a specification of the generic class and the values of these attributes

Combination of data and metadata allows for implementation of extensible designs

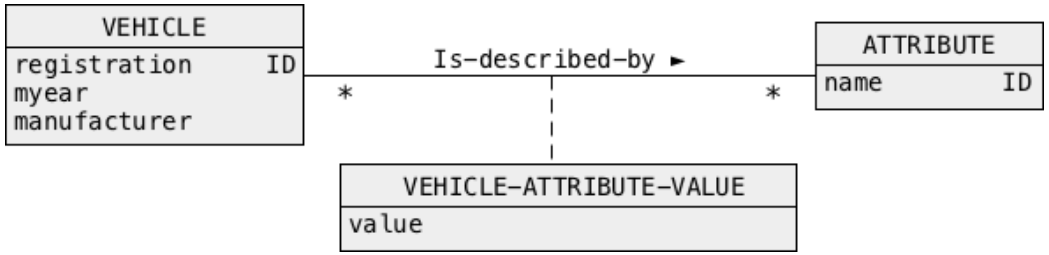
Generic classes

A generic class of objects is a class that combines data and metadata

Vehicles are described by a registration, manufacturer, and year when manufactured

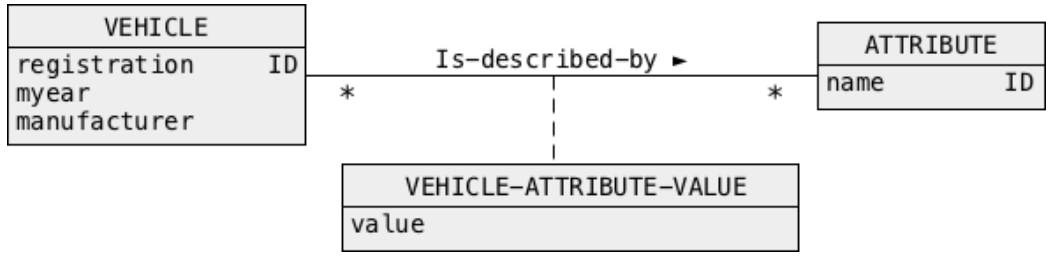


In the future, vehicles will be described by more attributes

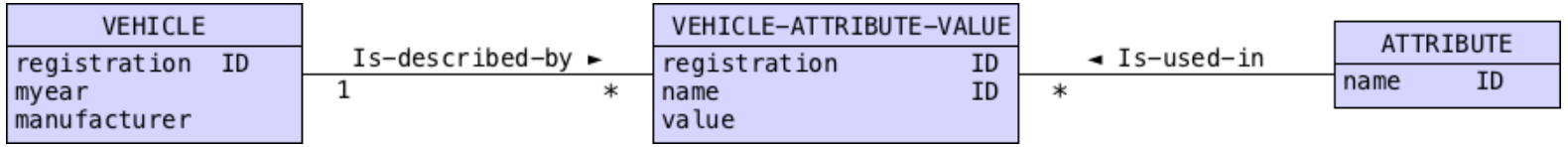


Generic classes

A design with a generic class of objects



Another design (same as above)



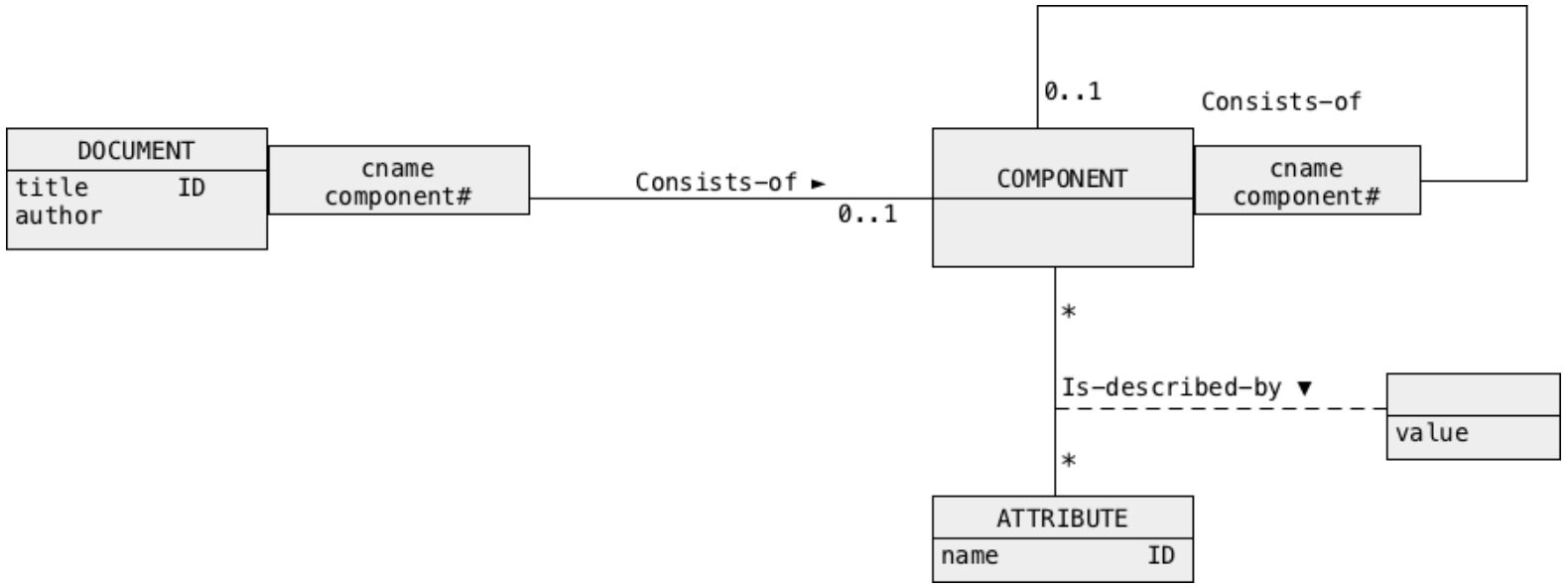
Generic classes

Documents consist of pages

Pages consists of paragraphs

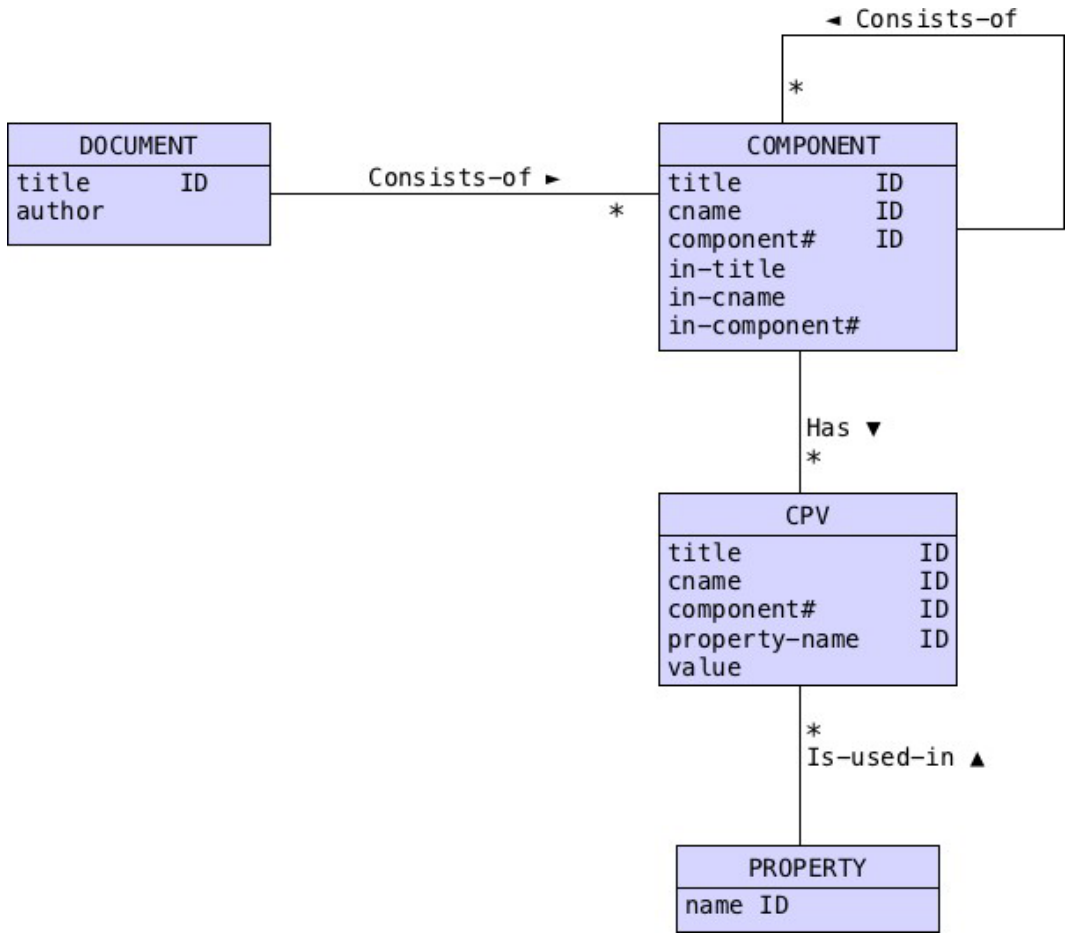
Paragraphs consist of sentences

Sentences consists of …



Generic classes

Another design (same as previous)

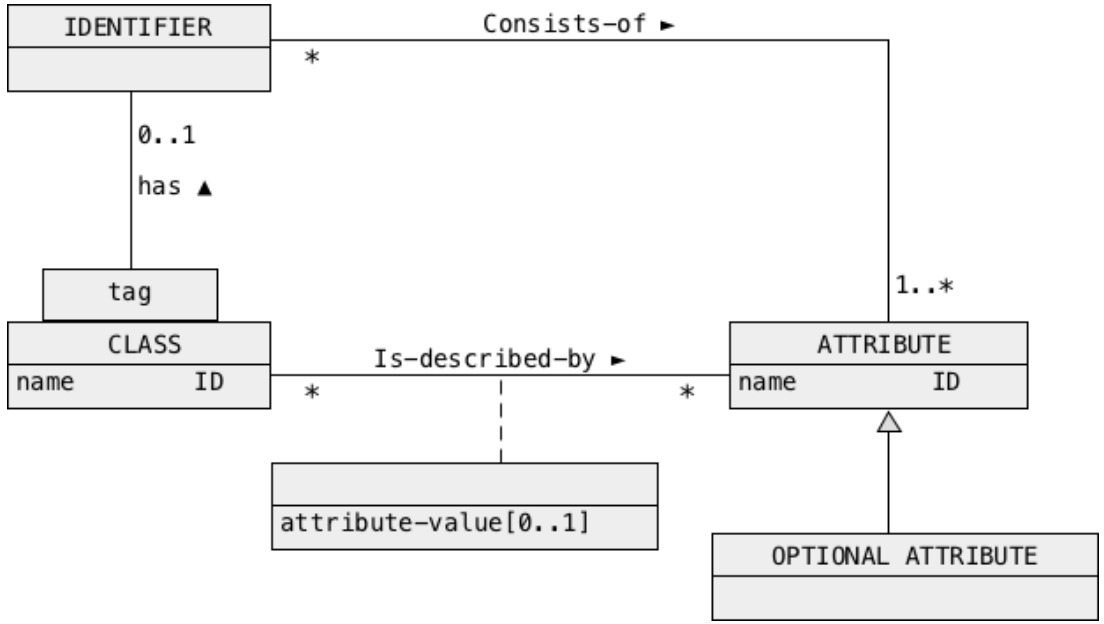


Generic classes

In the future, the new classes will be created and the classes will be described by the new attributes

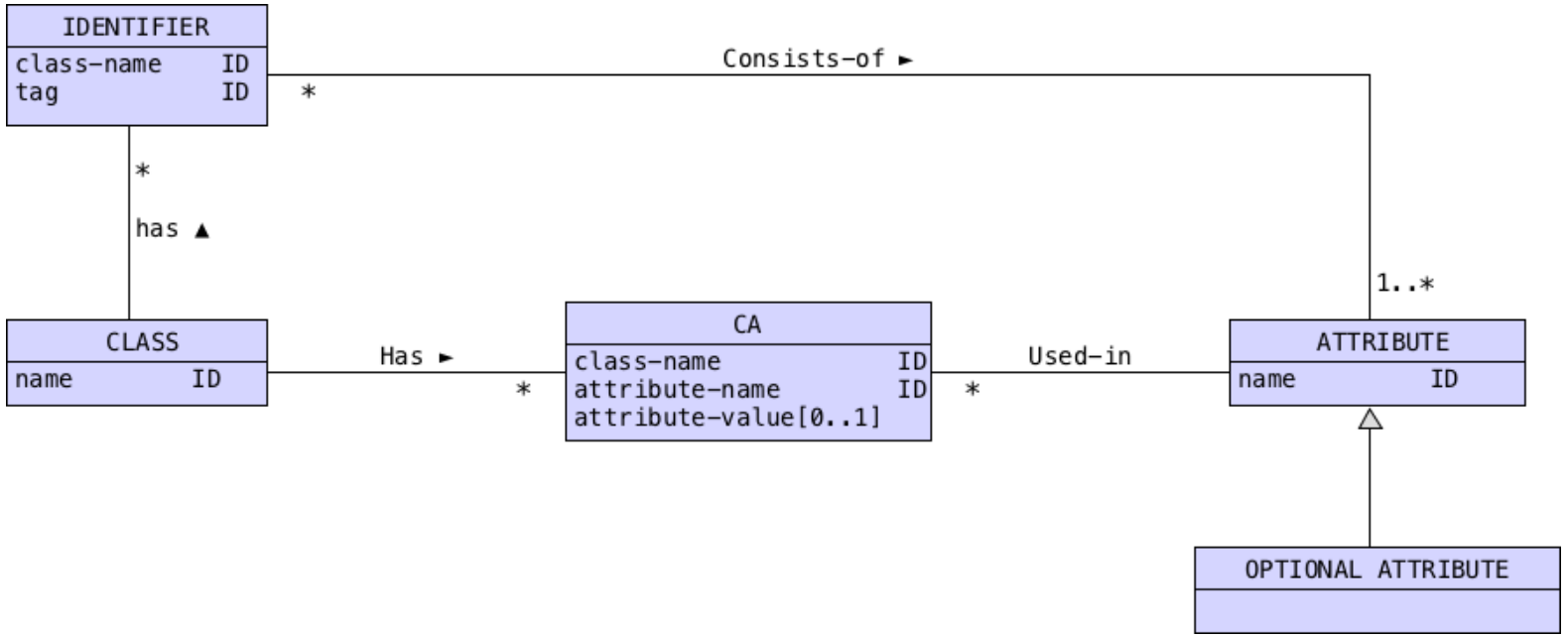
Some of the new attributes can be optional

We need to keep information about the dentifiers of new classes



Generic classes

Another design (same as previous)



Generic association

Is it possible to design a conceptual schema such that it can be extended by the new associations without changing anything in a specification of the schema ?

A generic association allows for unlimited extension of the design with the new associations without changing anything in a specification of the schema

A generic association is an association that combines data and metadata

Metadata contain information about the names of associations used in the schema, and multiplicities of the new associations

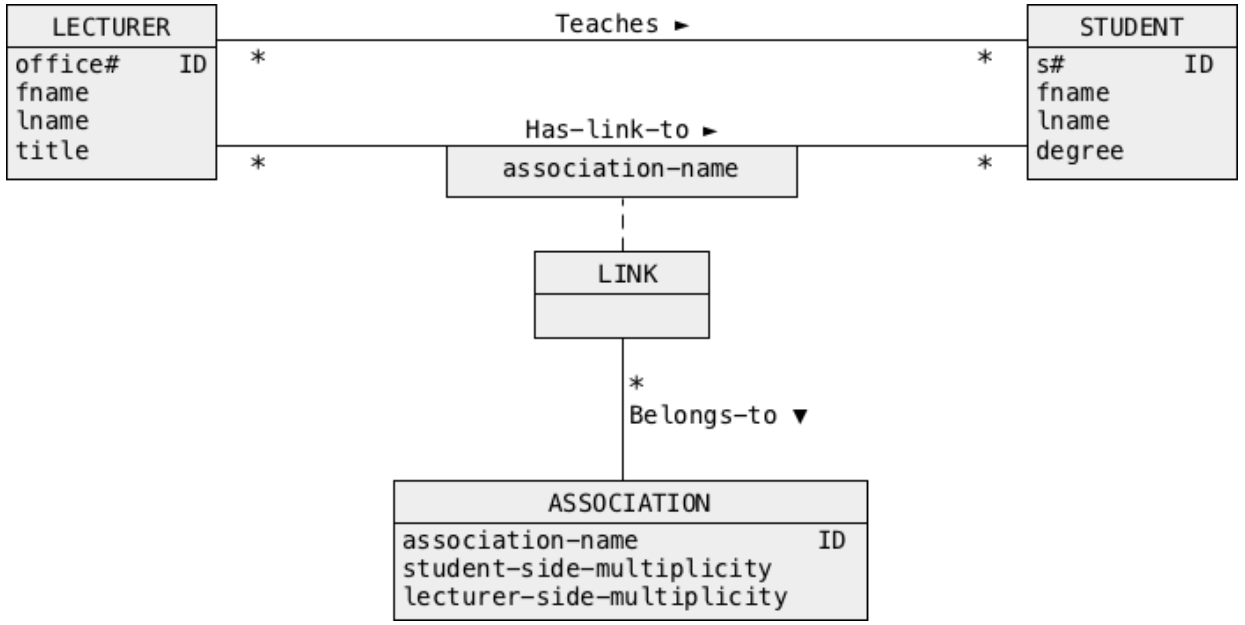
Combination of data and metadata allows for implementation of extensible designs

Generic association

Lecturers teach students

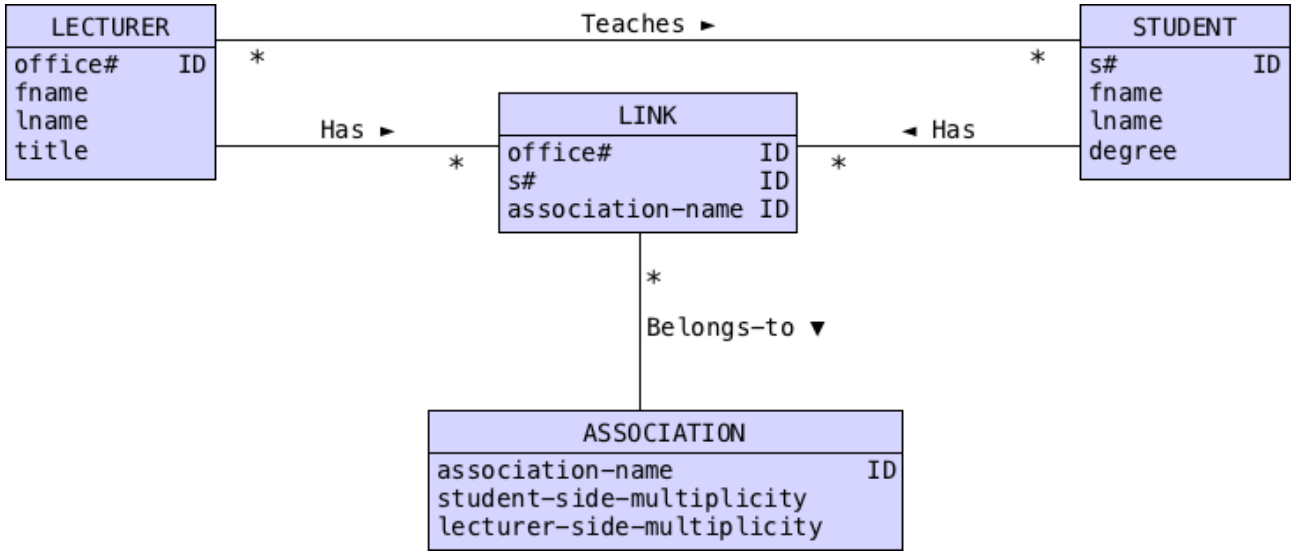
In the future we would like to add more associations between lecturers and students

We need to store information about association name and its multiplicities



Generic association

Another design (same as previous)



Metamodel

Data is information about instances of objects and links between the objects

A conceptual model (conceptual schema) is an abstraction of data

Metadata is information about a conceptual model, like for example, the names of classes, names of attributes, identifiers, names of associations, multiplicities of associations, etc.

Metamodel is an abstraction of metadata

References

BLAHA M., PREMERLANI W., Object-Oriented modelling and Design for Database Applications, 1998, chapter 3 & 4