

# Modeling I

## Class diagrams

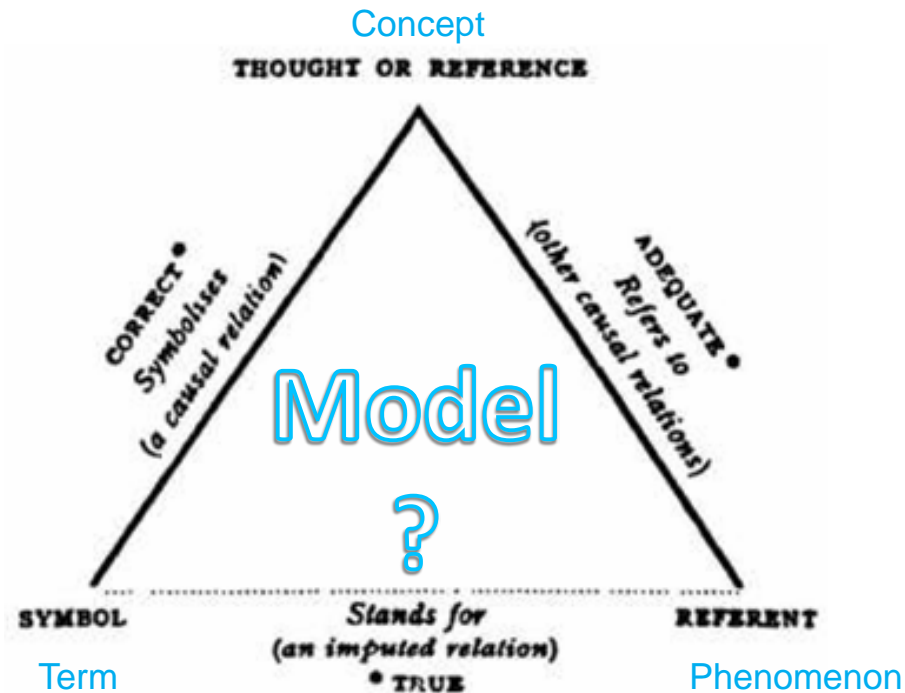
Ketil Stølen

*Partly based on slides prepared by [Prof. Øystein Haugen, HiØ & SINTEF](#)*

# Overview of lecture

- Modeling
  - What is it?
  - Why do we do it?
  - Modeling and Programming – sides of the same coin?
  
- UML Class modelling

# What's a Model?



Exercise: Explain class in the setting of the previous slide

- In which corner does class belong?
- What would you put in the two other corners?

# Artefacts in Informatics

## Abstraction

Models

Frameworks

Patterns

Algorithms

## Languages

Programming

GPL

DSL

Formal

Visual ....

## Tools

Editors

Compilers

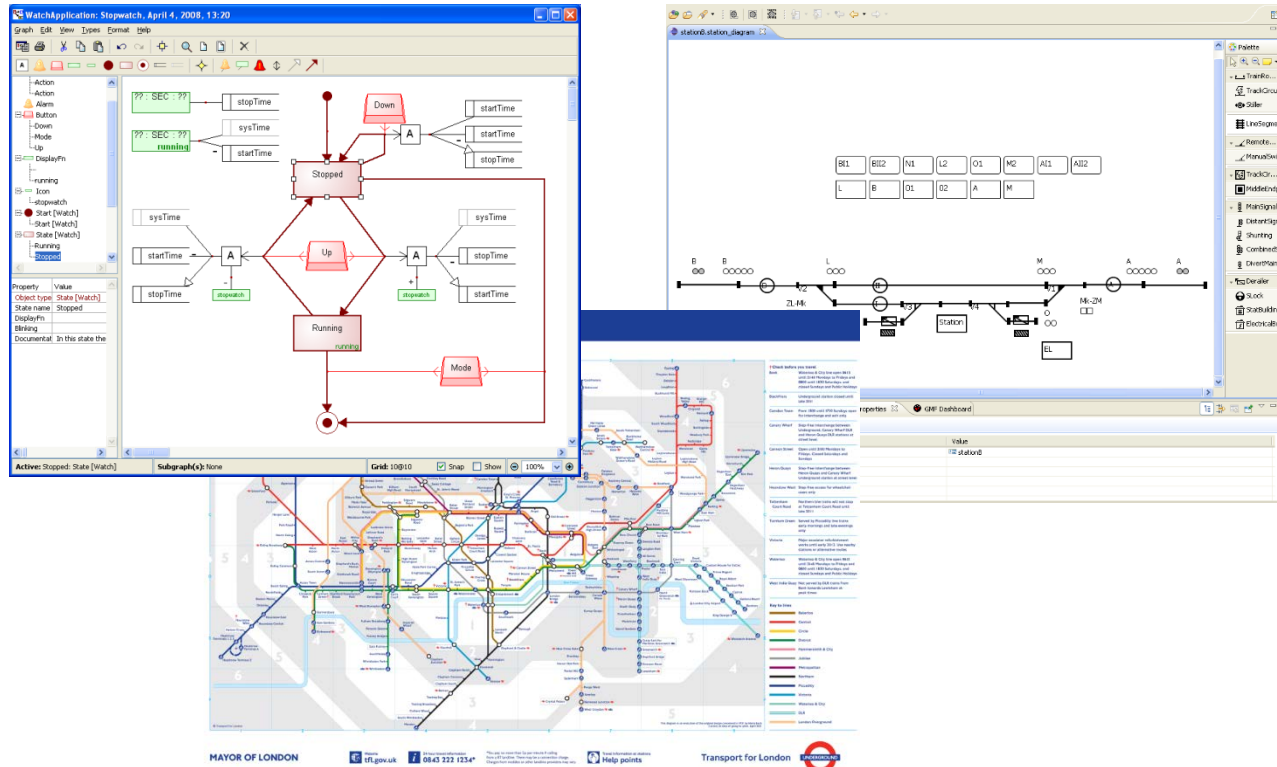
Verifiers

Simulators

Apps ....

Exercise: How do the other languages you have been thought fit in the previous picture?

# Why make a language?



# UML Class modelling

- Concepts
- Inheritance
- Generation
- Composition
- Meta



# Concepts

Class

Type

Pattern

Method

Function

Datatype

Object

Instance

Entity

Method call

Function call

Variable

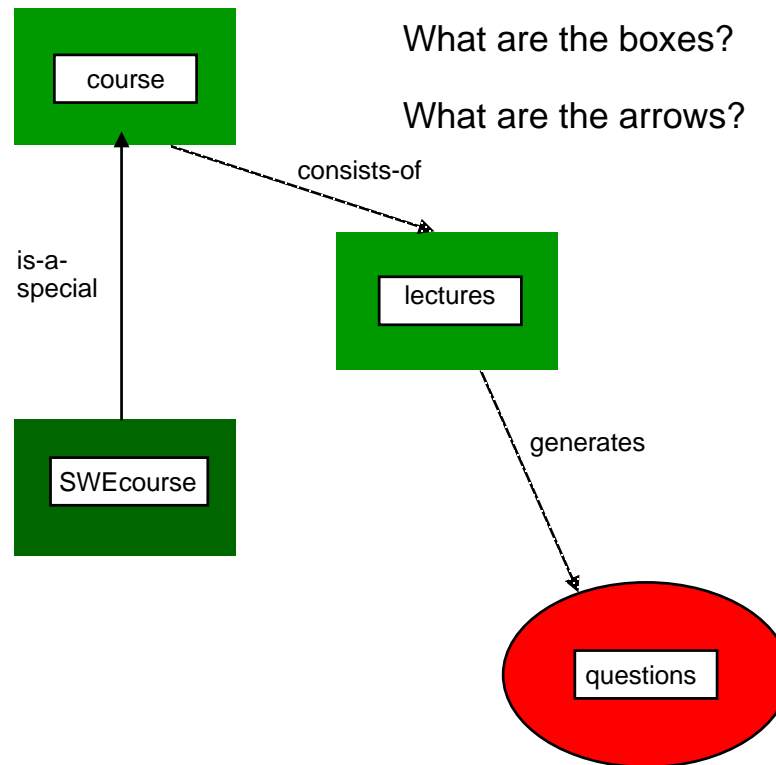
Prototype

Clone

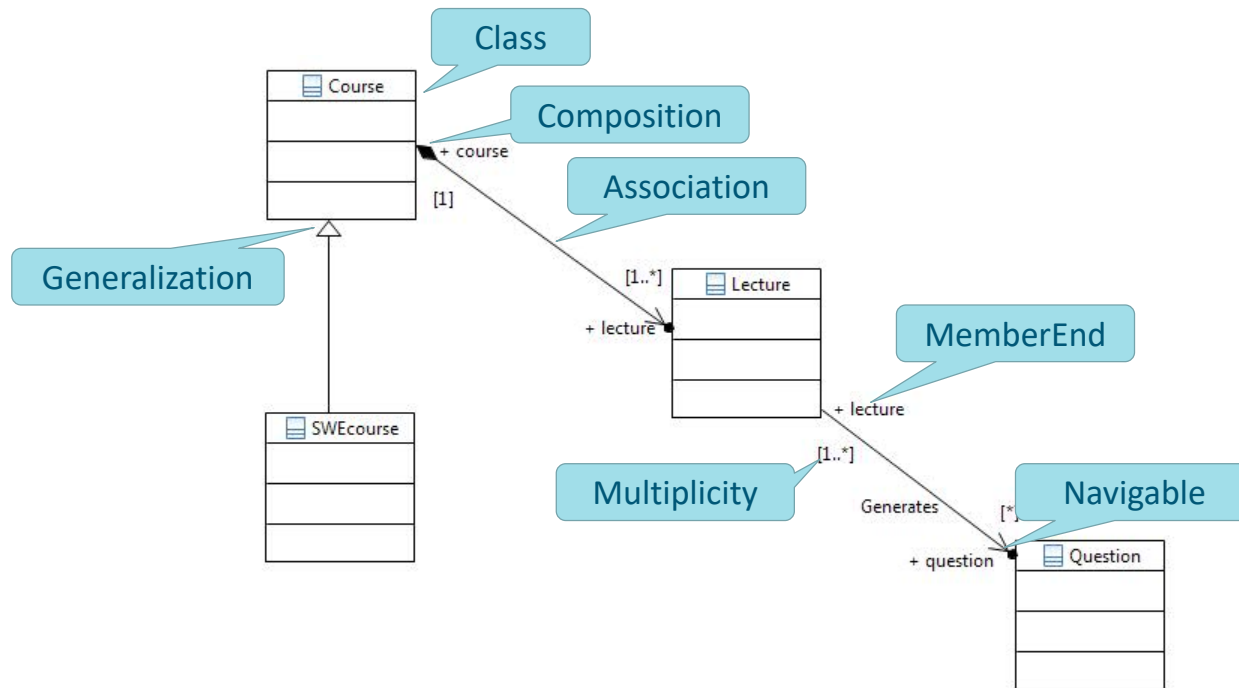
# A small story about Courses

- The Software Engineering Course is a special Course
- Courses contain Lectures
- The lectures may generate questions

# A small Story with Boxes and Arrows

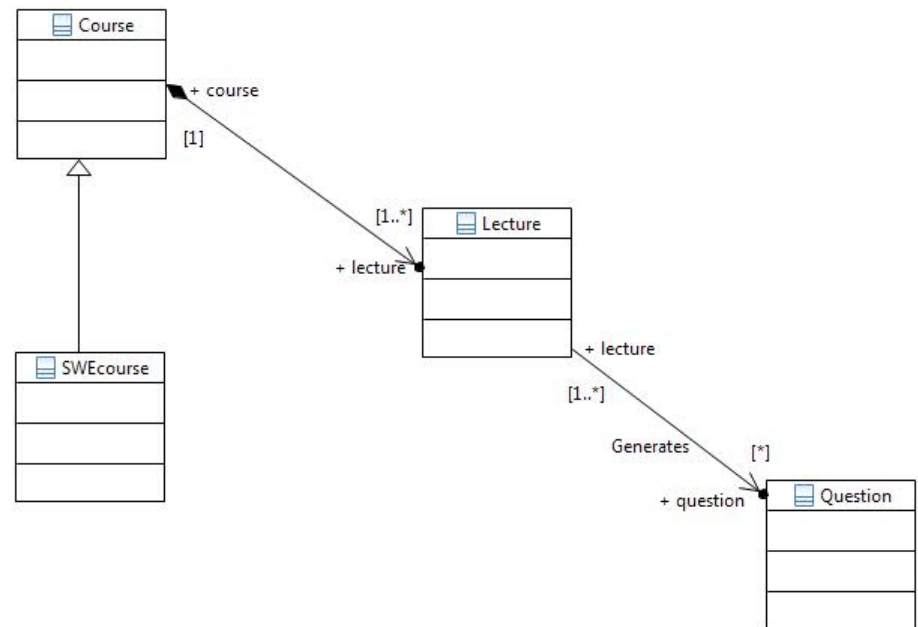


# A small Story with UML class diagram

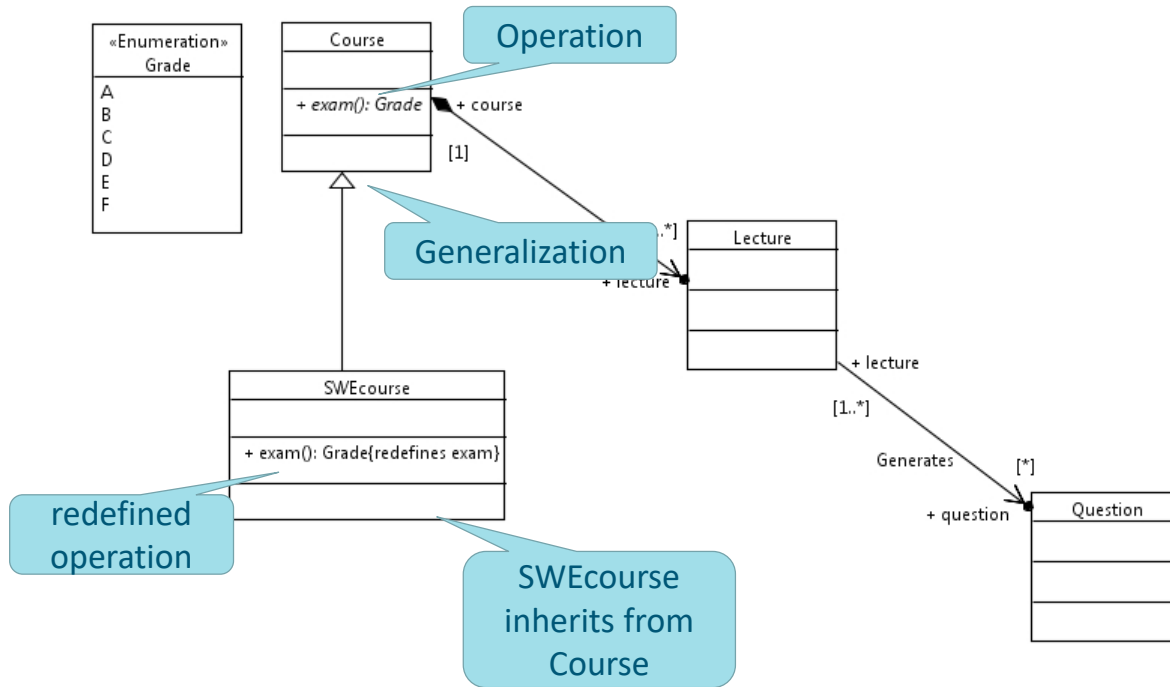


## Exercise:

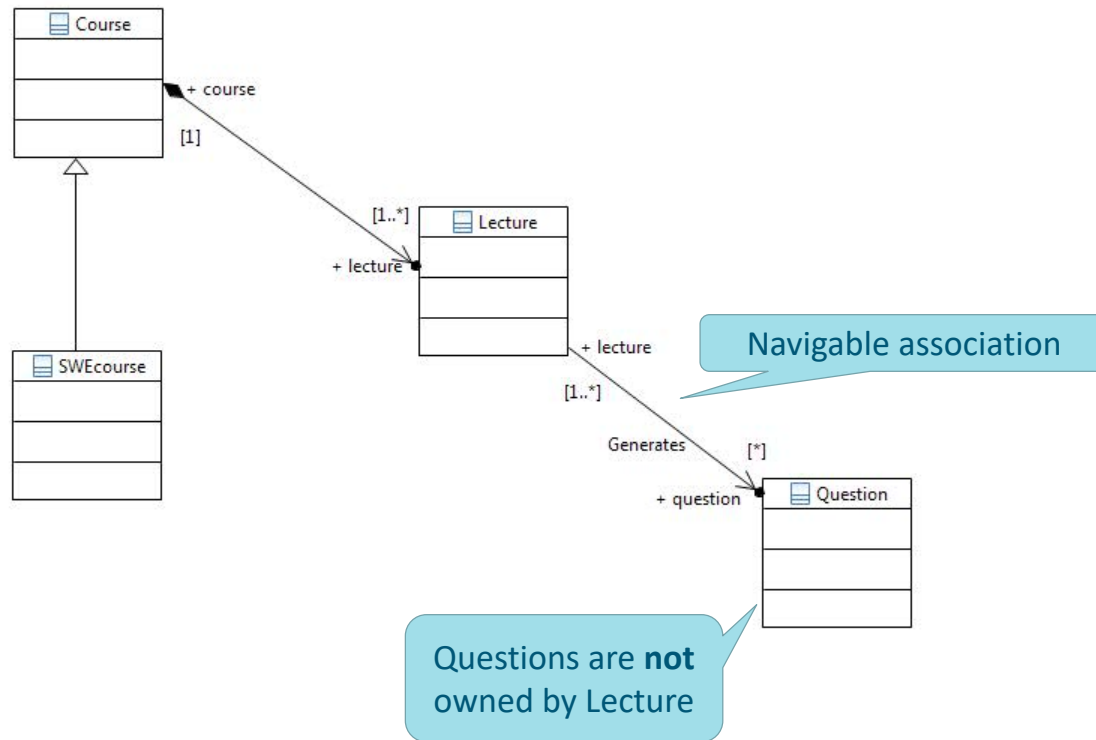
- Can Software Engineering course (SWEcourse) be held without lectures?
- Can there be lectures without questions asked?
- Can the very same lecture be given in two different courses?
- Can the very same question be posed to several lectures?
- If a course is cancelled, will all remaining lectures also be cancelled? (or "terminated")



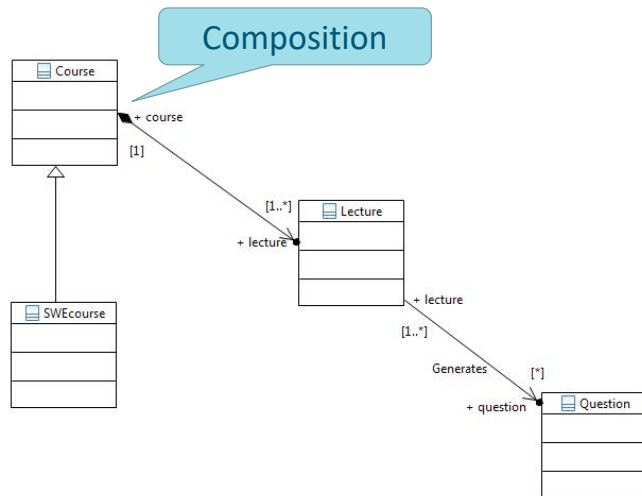
# Inheritance



# Generation

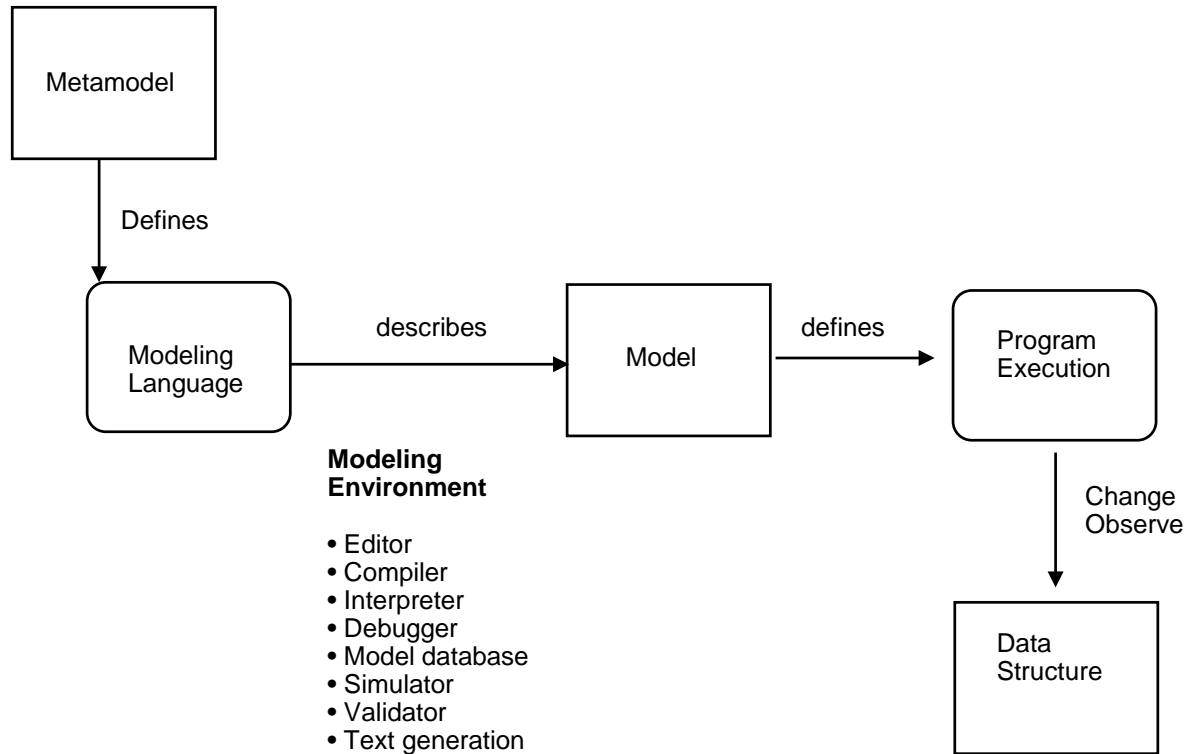


# Composition





# Meta



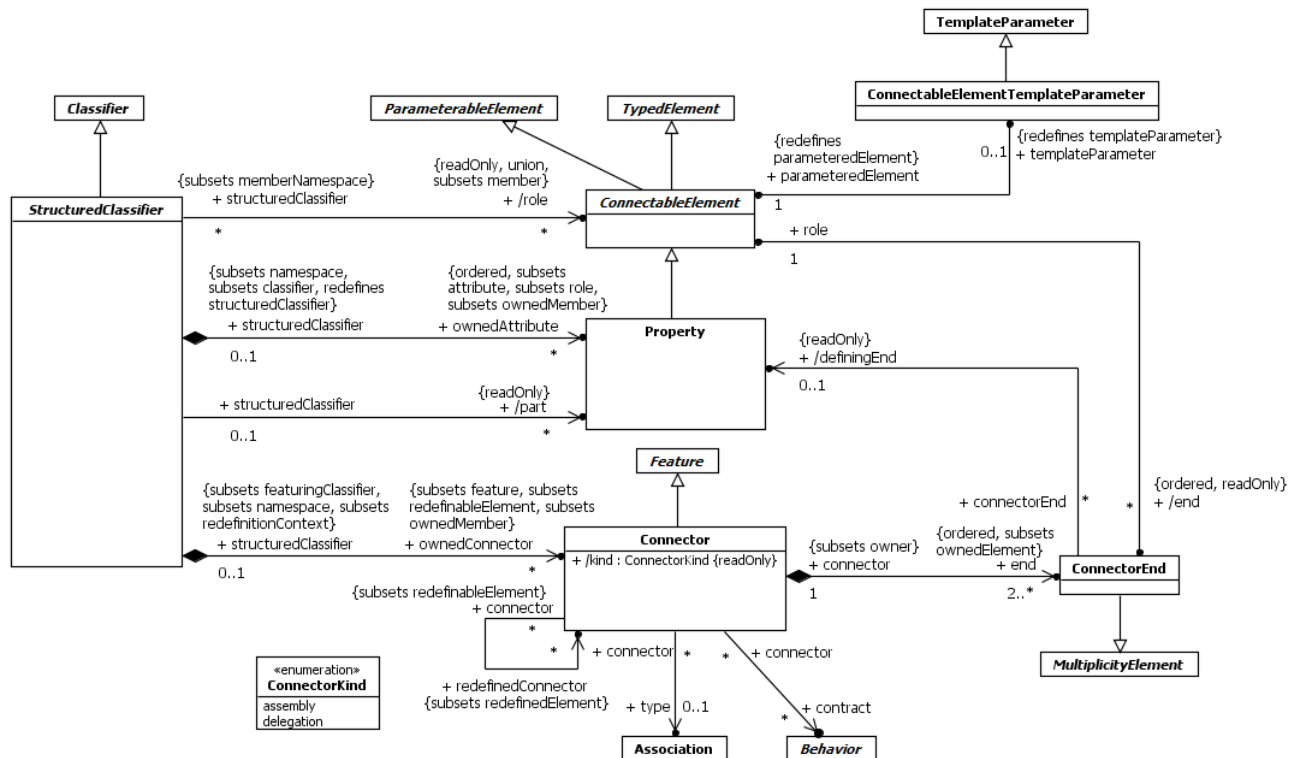
# Exercise: Explain the previous slide wrt the language English

- What is the meta-model?
- What is the modeling-language?
- What is a model?
- What is program execution?
- What is the data structure?

# The 4-level meta hierarchy

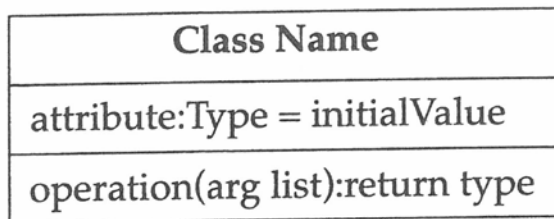
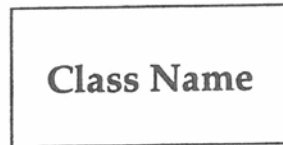
Lev	UML model	Language	Programming	Language
M3	MOF metamodel	MOF	Grammar of BNF	BNF?
M2	UML metamodel	MOF	Grammar of Java	BNF
M1	UML user model	UML	Java user program	Java
M0	Execution of user model		Execution of java program	

# A piece of the UML Metamodel

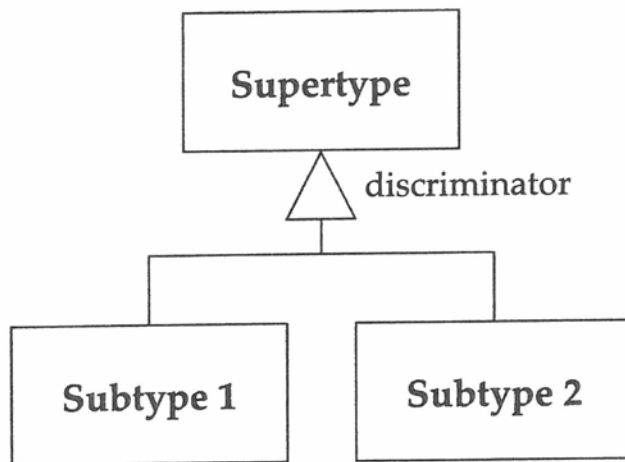


# Class Diagram Summary

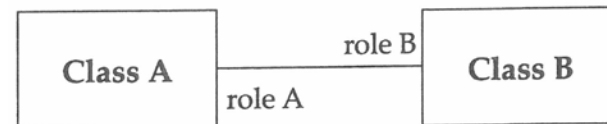
## Class



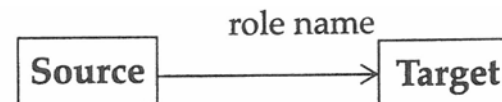
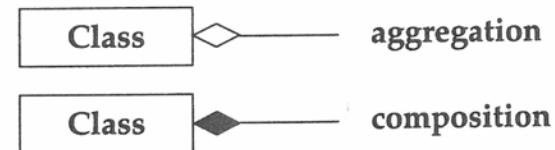
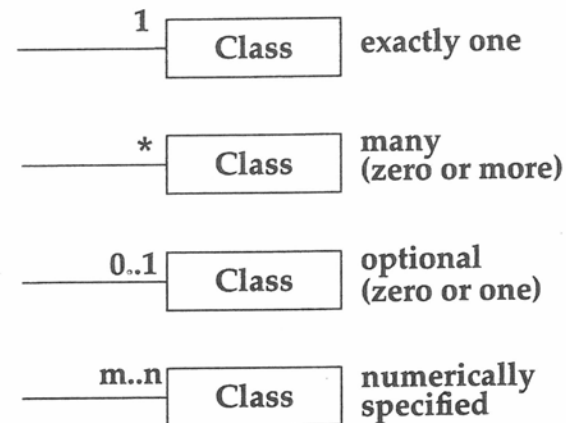
## Generalization



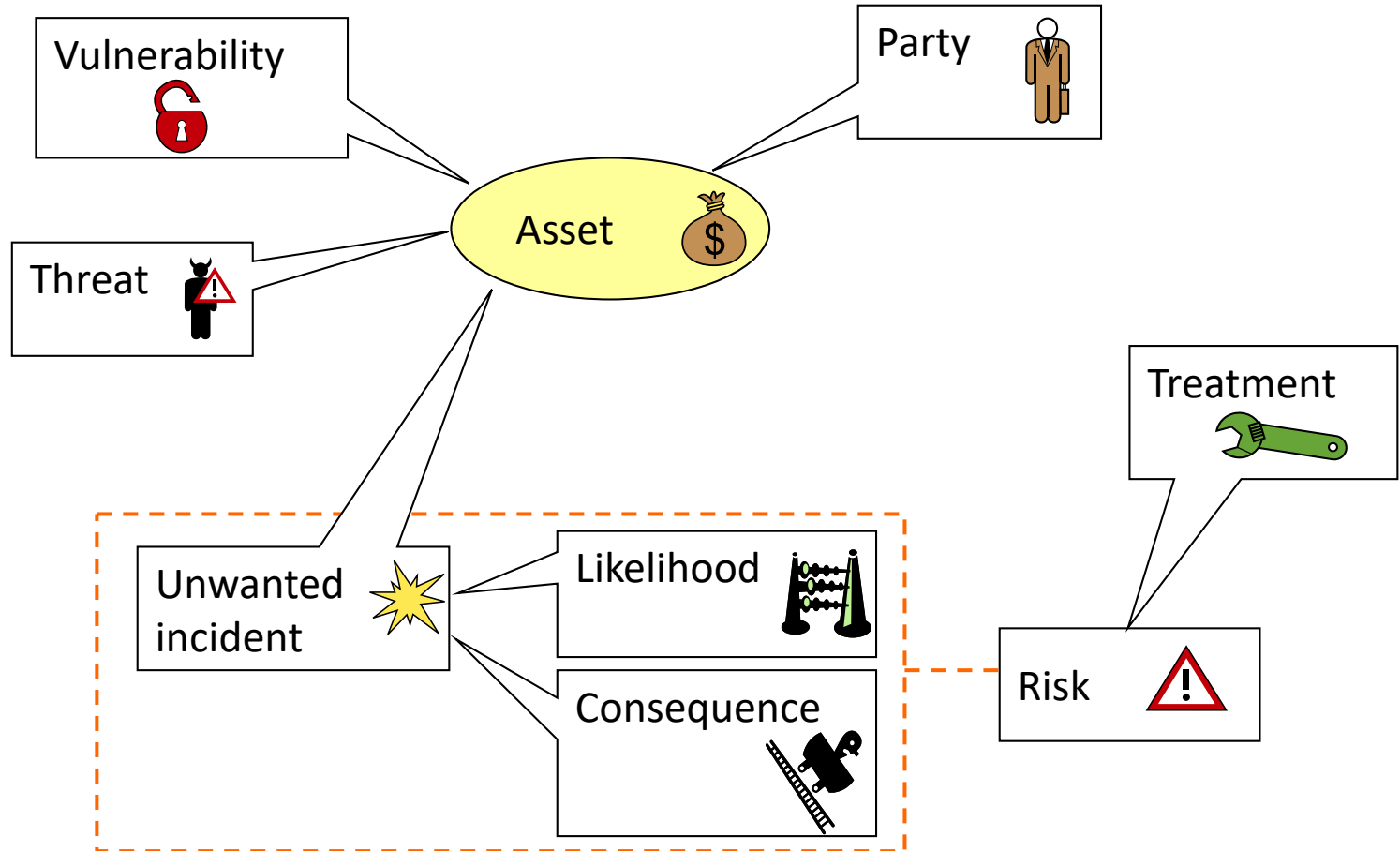
## Association



## Multiplicities



# Exercise: Represent the drawing below in UML



# Modeling tool used for the UML part of this course

You may use the tool of your preference

Some alternatives:

- <https://www.eclipse.org/papyrus/> (powerful but involves a lot to install and use)
- [https //www.draw.io](https://www.draw.io) app (light weight)