

Domain Modelling

COMP2511, CSE, UNSW



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Domain Models

- Domain Models are used to **visually represent** important domain **concepts** and **relationships** between them.
- Domain Models help **clarify** and **communicate** important domain specific concepts and are used during the requirements gathering and **designing phase**.
- **Domain modeling** is the activity of expressing related domain concepts into a domain model.
- Domain models are also often referred to as *conceptual models* or *domain object models*.
- We will be use Unified Modeling Language (**UML**) **class diagrams** to represent domain models.
- There are many different modelling frameworks, like: UML, Entity-Relationship, Mind maps, Context maps, Concept diagrams. etc.

Requirements Analysis vs Domain modelling

- **Requirements analysis** determines *external behaviour*
“*What are the features of the system-to-be and who requires these features (actors)*”
- **Domain modelling** determines (internal behavior) –
“*how elements of system-to-be interact to produce the external behaviour*”
- Requirements analysis and domain modelling are **mutually dependent** - domain modelling supports clarification of requirements, whereas requirements help building up the model.

What is a domain?

- *Domain* – A sphere of knowledge particular to the problem being solved
- *Domain expert* – A person expert in the domain
- For example, in the domain of cake decorating, cake decorators are the domain experts

Problem

A motivating example:

- Tourists have schedules that involve at least one and possibly several cities
- Hotels have a variety of rooms of different grades: standard and premium
- Tours are booked at either a standard or premium rate, indicating the grade of hotel room
- In each city of their tour, a tourist is booked into a hotel room of the chosen grade
- Each room booking made by a tourist has an arrival date and a departure date
- Hotels are identified by a name (e.g. Melbourne Hyatt) and rooms by a number
- Tourists may book, cancel or update schedules in their tour

Ubiquitous language

- **Things in our design must represent real things in the domain expert's mental model.**
- For example, if the domain expert calls something an "order" then in our domain model (and ultimately our implementation) we should have something called an Order.
- Similarly, our domain model should not contain an OrderHelper, OrderManager, etc.
- Technical details do not form part of the domain model as they are not part of the design.

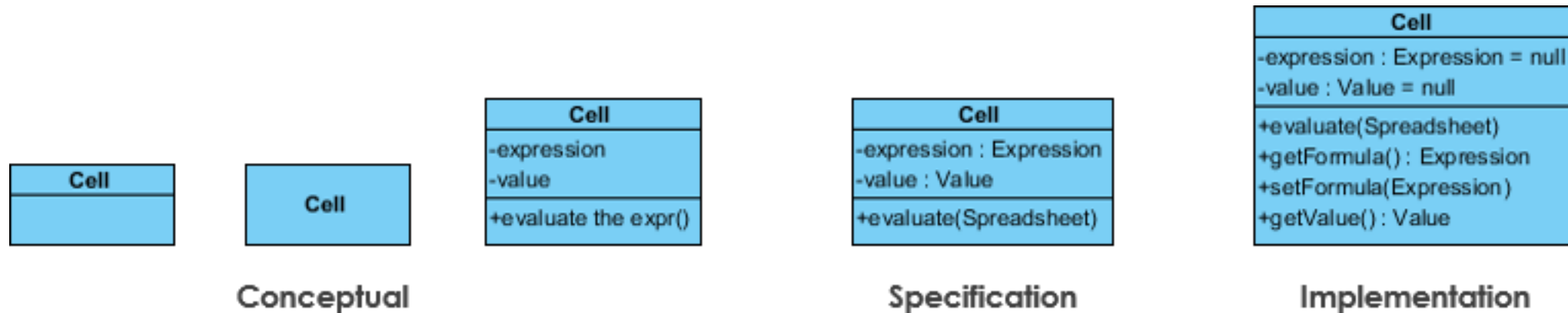
Noun/verb analysis

- Finding the ubiquitous language of the domain by finding the **nouns** and **verbs** in the requirements
- The **nouns** are possible entities in the domain model and the **verbs** possible behaviours

Problem

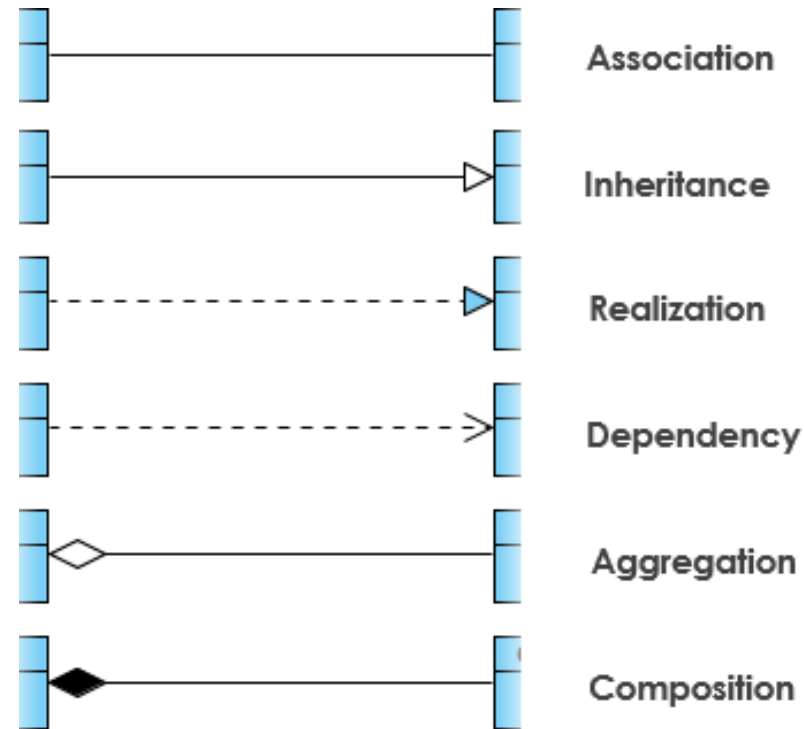
- The **nouns** and **verbs**:
 - **Tourists** have **schedules** that involve at least one and possibly several **cities**
 - **Hotels** have a variety of **rooms** of different **grades**: standard and premium
 - **Tours** are **booked** at either a standard or premium rate, indicating the **grade** of hotel **room**
 - In each **city** of their **tour**, a **tourist** is **booked** into a hotel **room** of the chosen **grade**
 - Each room **booking** made by a tourist has an arrival **date** and a departure **date**
 - **Hotels** are identified by a **name** (e.g. Melbourne Hyatt) and **rooms** by a **number**
 - **Tourists** may **book**, **cancel** or **update** **schedules** in their **tour**

UML Class diagrams: Perspectives



* Above diagram is from: <https://www.visual-paradigm.com/guide/uml-unified-modeling-language/uml-class-diagram-tutorial/>

UML Class diagrams: Relationships



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UML Class diagrams

Dependency ----->

- The loosest form of relationship. A class in some way *depends* on another.

Association _____

- A class "uses" another class in some way. When undirected, it is not yet clear in what direction dependency occurs.

Directed
Association ----->

- Refines association by indicating which class has knowledge of the other

UML Class diagrams

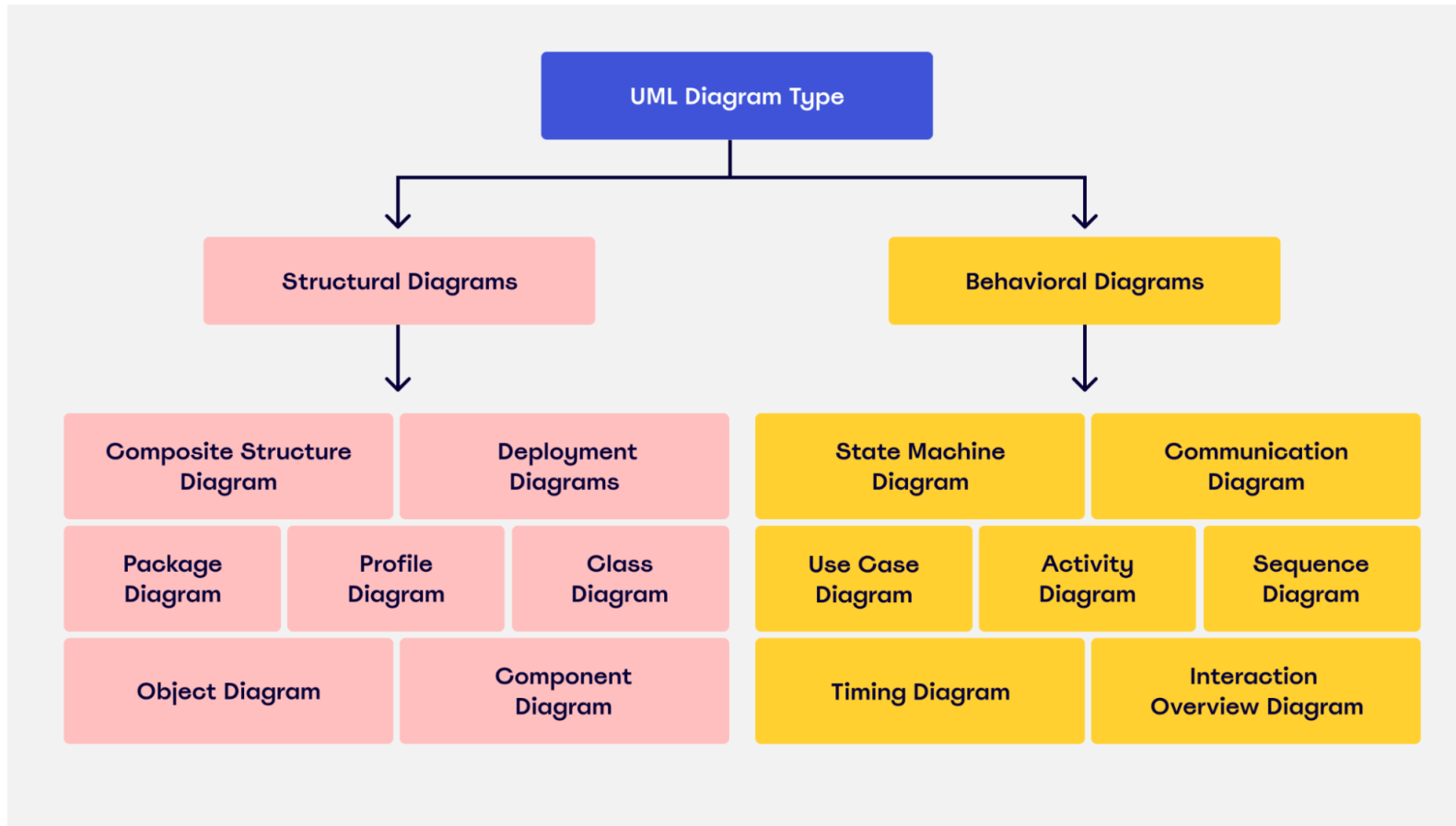
Aggregation 

- A class contains another class (e.g. a course contains students). Note that the diamond is at the end with the containing class.

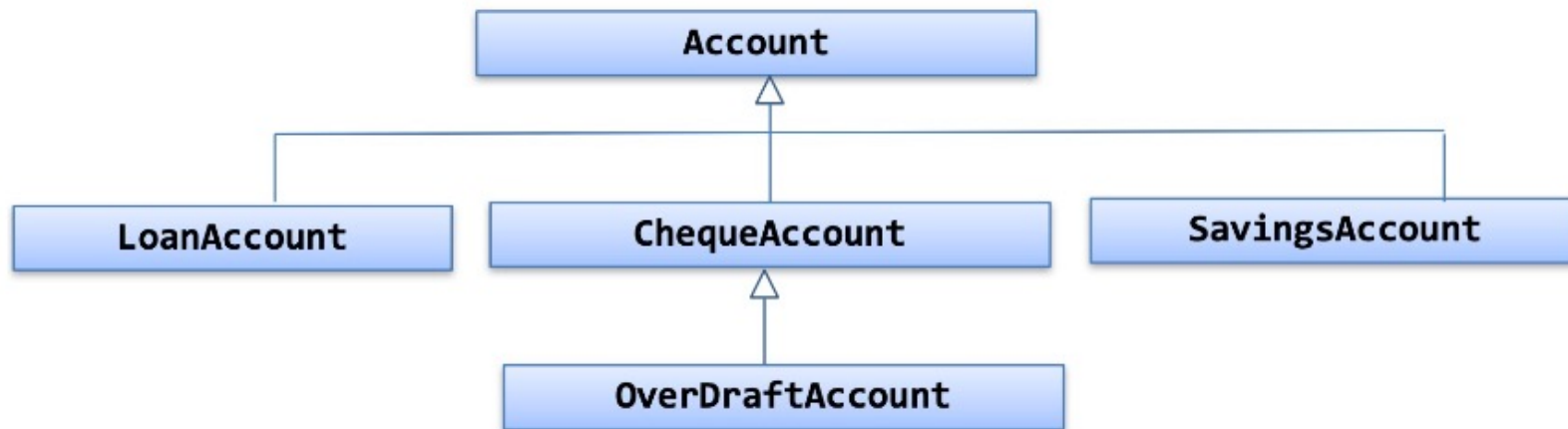
Composition 

- Like aggregation, but the contained class is integral to the containing class. The contained class cannot exist outside of the container (e.g. the leg of a chair)

UML Diagram Types



Examples



Examples

class (class diagram)

Account

-name: String
-balance: float

+getBalance(): float
+getName() : String
+withDraw(float)
+deposit(float)

object instances (object diagram)

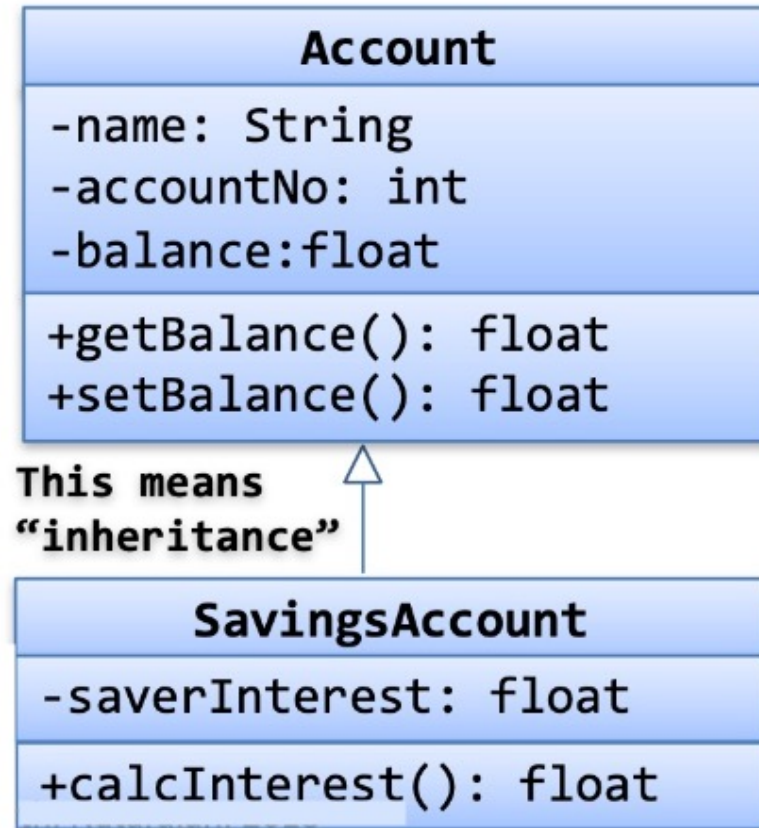
a1:Account

name = "John Smith"
balance = 40000

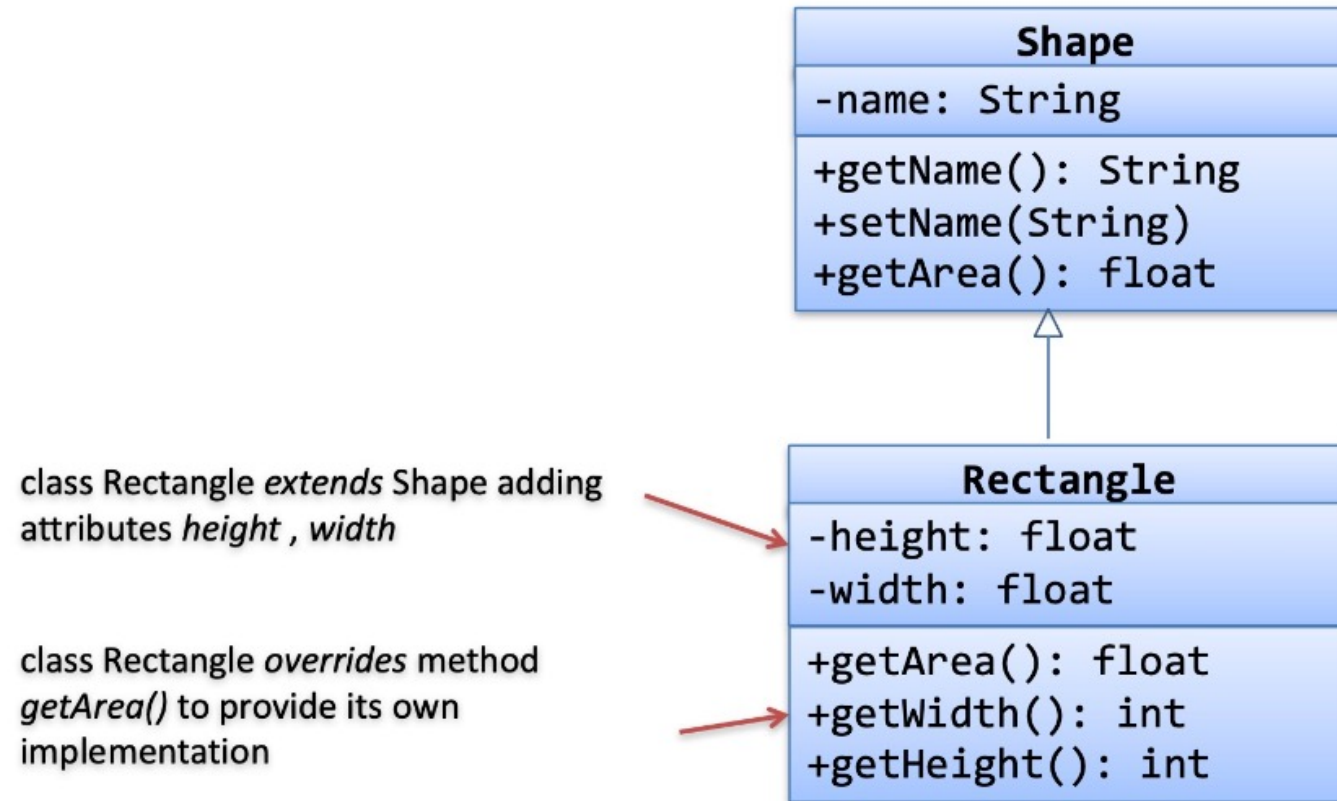
a2:Account

name = "Joe Bloggs"
balance = 50000

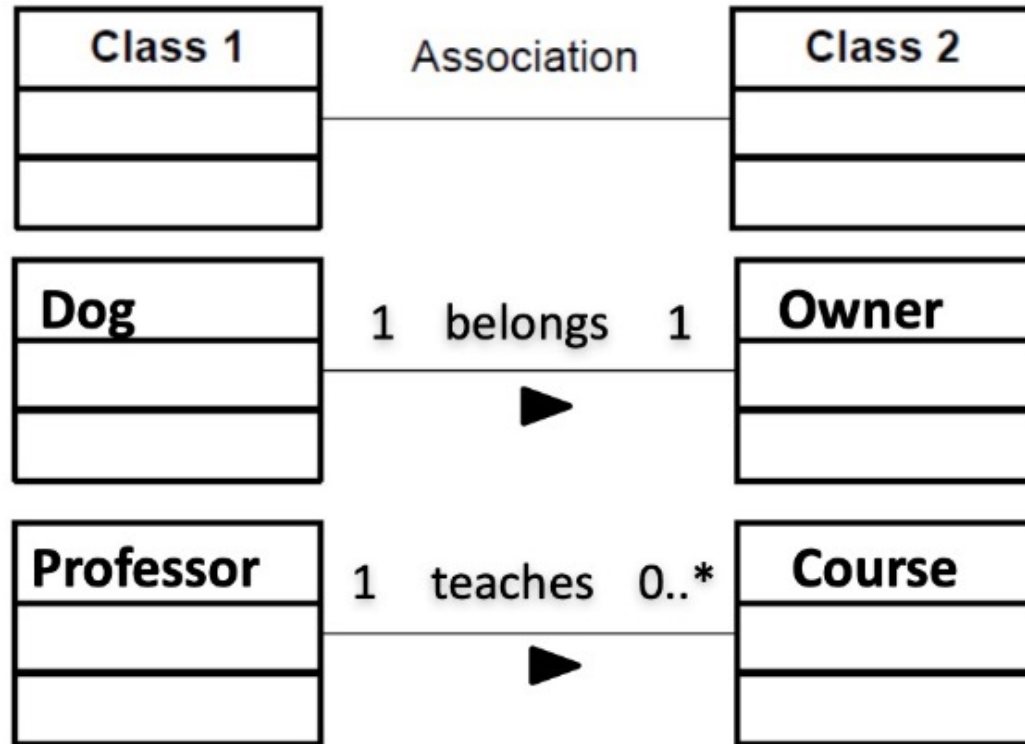
Representing classes in UML



Representing classes in UML



Representing Association in UML

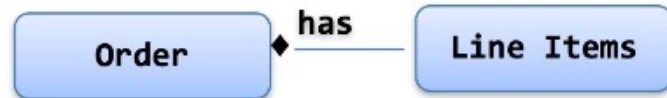


Representing Association in UML

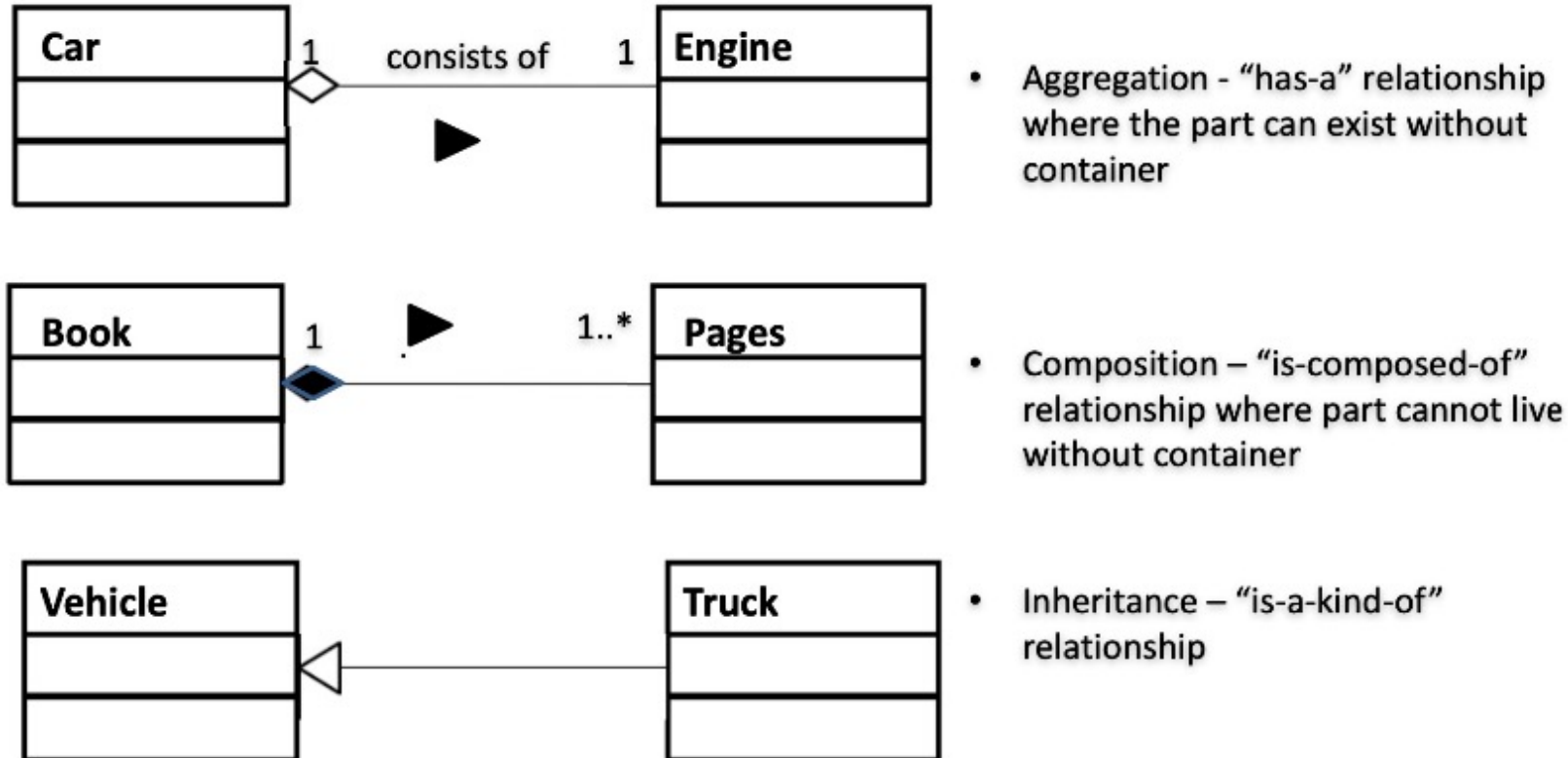
- Associations can model a ***“has-a”*** relationship where one class “contains” another class
- Associations can further be refined as:
Aggregation relationship (hollow diamond symbol ◇): The contained item is an element of a collection but it can also exist on its own, e.g., a lecturer in a university or a student at a university



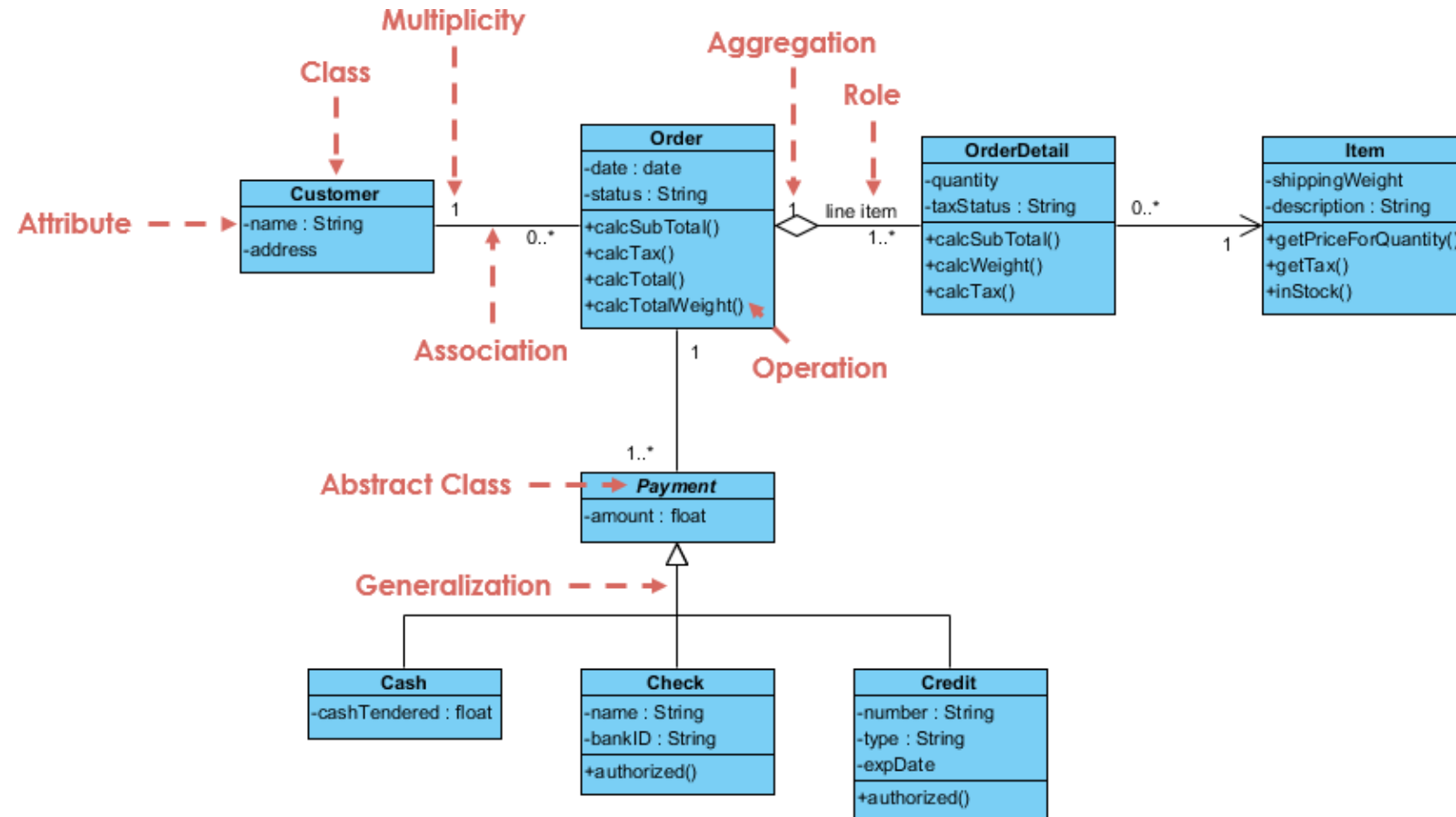
Composition relationship (filled diamond symbol ◆ in UML diagrams): The contained item is an integral part of the containing item, such as a leg in a desk, or engine in a car



Representing Association in UML

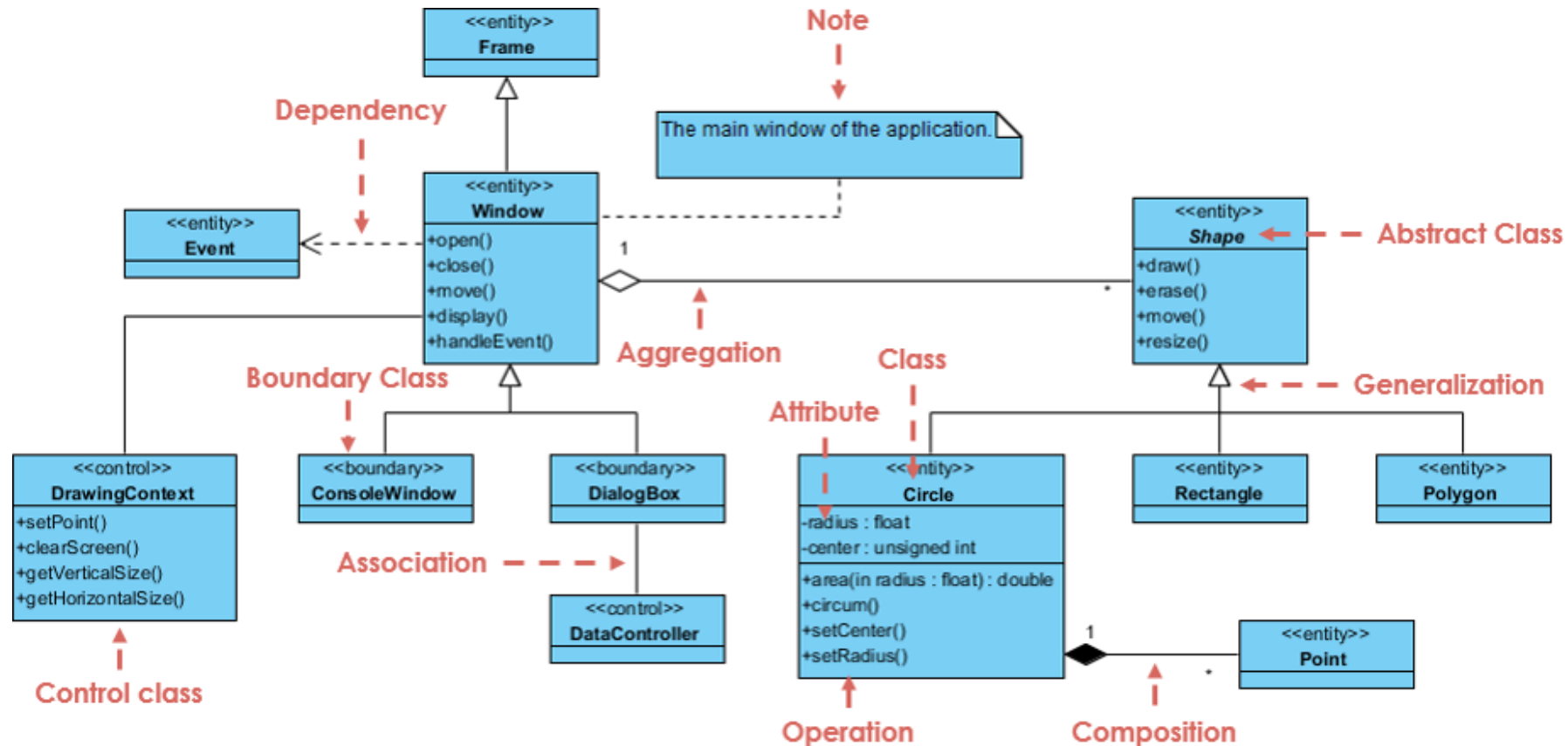


Class Diagram Example: Order System



* Above diagram is from: <https://www.visual-paradigm.com/guide/uml-unified-modeling-language/uml-class-diagram-tutorial/>

Class Diagram Example: GUI



* Above diagram is from: <https://www.visual-paradigm.com/guide/uml-unified-modeling-language/uml-class-diagram-tutorial/>

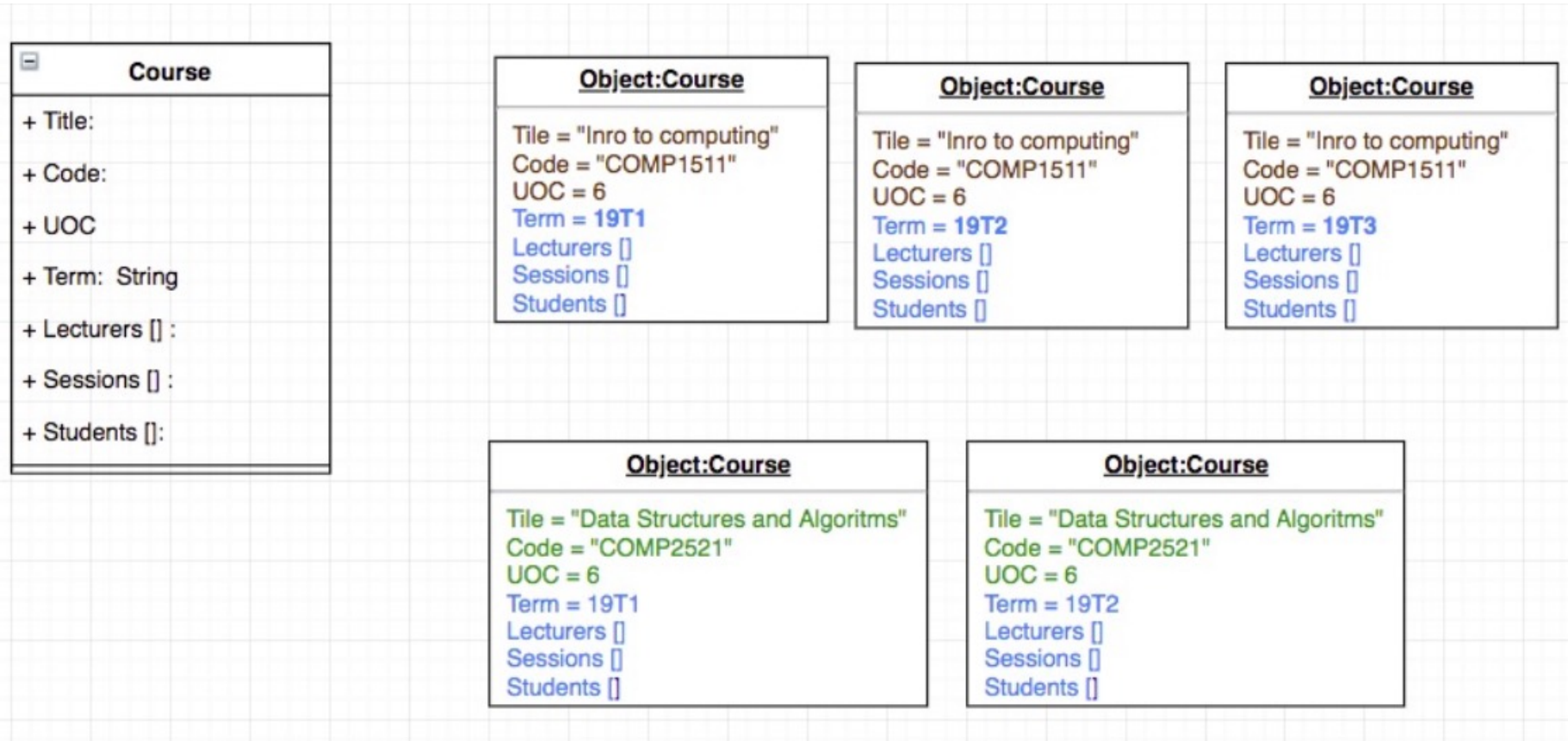
Attributes vs. Classes

- ❖ The most common confusion – *should it be an attribute or a class?*
 - when creating a domain model, often we need to decide whether to represent *something* as an *attribute* or a conceptual *class*.
- ❖ If a concept is **not** representable by a *number* or a *string*, most likely it is a *class*.
- ❖ For example:
 - a *lab mark* **can** be represented by a *number*, so we should represent it as an *attribute*
 - a *student* **cannot** be represented by a *number* or a *string*, so we should represent it as a *class*

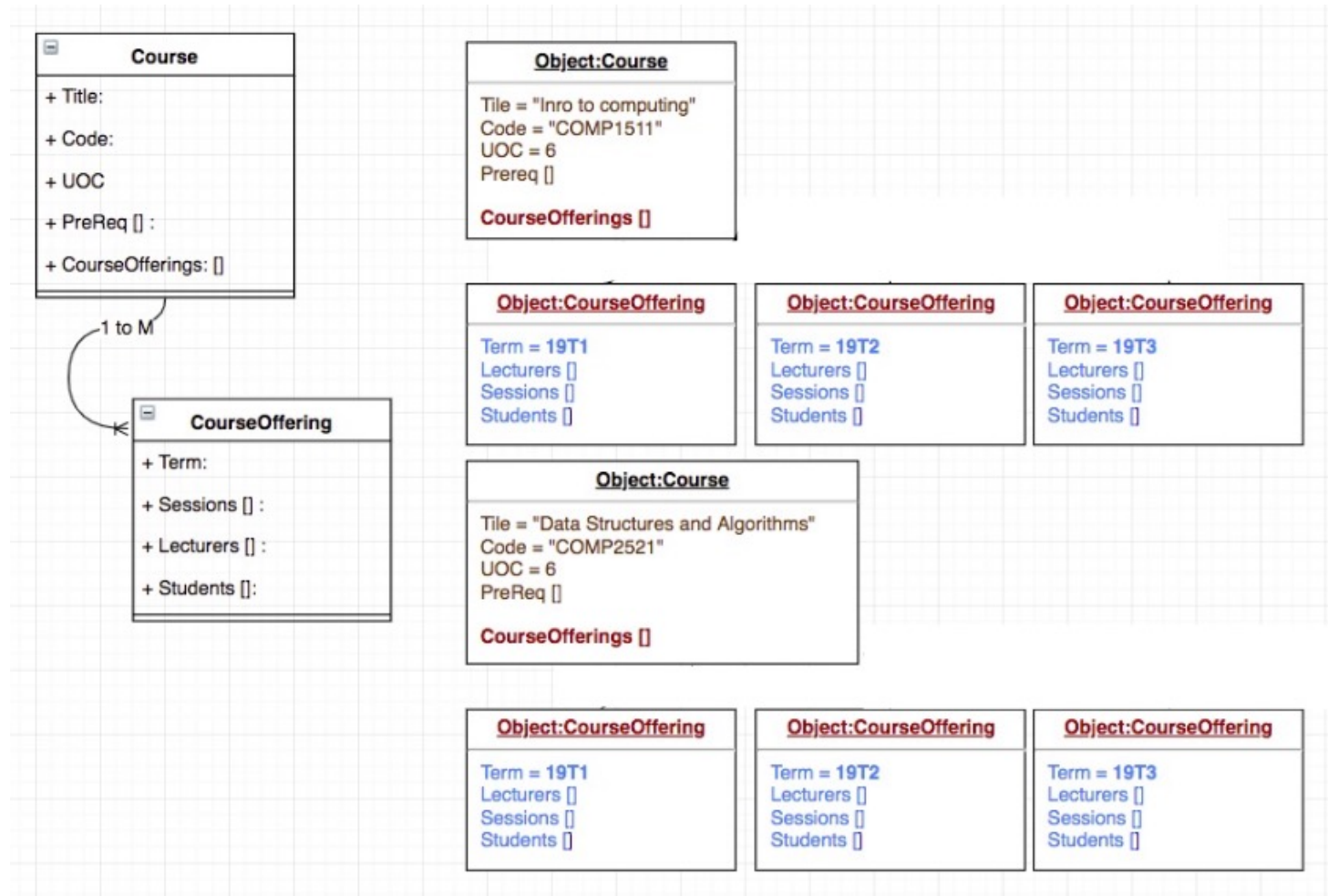
Attributes vs. Classes



What is wrong with the following?



A Possible solution



References

- ❖ A very detailed description of UML
 - <https://www.uml-diagrams.org/>
- ❖ Books that go into detail on Domain Driven Design
 - *Domain-Driven Design: Tackling Complexity in the Heart of Software* by Eric Evans.
 - *Domain Modeling Made Functional: Tackle Software Complexity with Domain-Driven Design and F#* by Scott Wlaschin.