SE 2AA4, CS 2ME3 (Introduction to Software Development)

Winter 2018

26 Specification Via UML (Ch. 5 and others)

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26 Specification Via UML (Ch. 5 and others)

- Administrative details
- Software tool of the day
- Best specification technique?
- Designing spec of modules
- Interfaces in UML
  - Measurable interface
  - Multiple inheritance example
- Generic classes in UML
- Use cases with UML
- Sequence diagrams in UML

Administrative Details

- A3
  - Part 1 - Solution: Mar 18
  - Part 2 - Code: due 11:59 pm Mar 26
- A4
  - Your own design and specification
  - Model module for game of Freecell
  - Due April 9 at 11:59 pm
- Sources of slides
  - DataSet example based on Cay Horstmann, Big Java, John Wiley & Sons, 2002
  - Other UML examples from Stevens, Using UML, 2006
  - Ghezzi et al 2003

Software Tool of the Day

draw.io

Best?

- What is the best software development tool?
- What is the most important software design principle?
- What is the best specification technique?
- What is the best programming language?
- What is the best engineering/scientific discipline?
- What is the best movie? video game?
- What is the best genre of music?
- What is the best food?

Deciding the Best Strategy For a Given Problem

- Many ways to accomplish the same goals, each with pros and cons
- What is the approach at your company?
- Likely maintenance, so many decisions have likely been made
- What tools/techniques/programming language etc. do you know?
- What can you afford in terms of cost/time?
- What tool is appropriate for the task at hand?
- What are the requirements?
  - Verifiability?
  - Maintainability?
  - Reusability?
  - etc.
- etc.

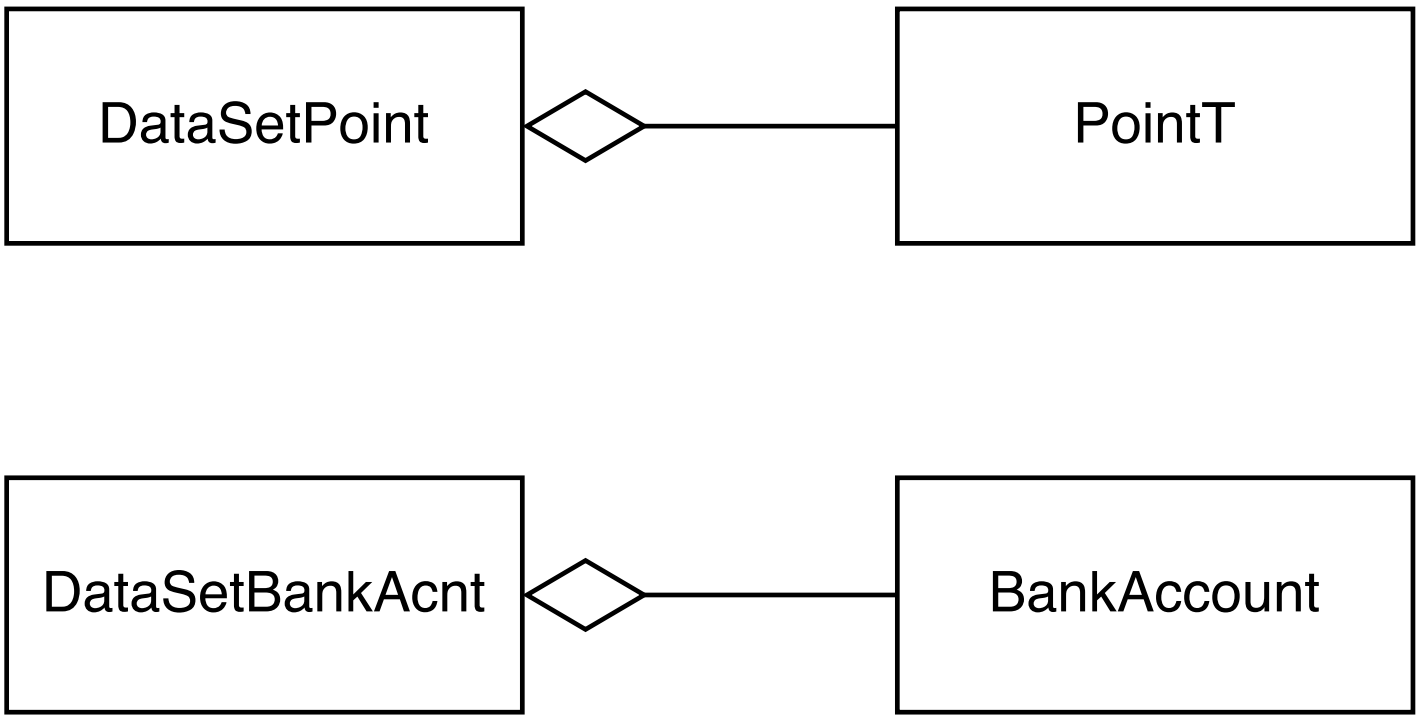
Modelling Larger Components

- From last day, Baber focuses on translating low level mathematical expressions
- In our specification, we will also need to organize the information
- For larger problems, think about your types, Abstract Data Types and Abstract objects
- Interactively switch between types, ADTs, Abstract Objects and detailed mathematical spec
- Example
  - Modelling game state for Freecell
  - What are some potential types?
  - What are some mathematical expressions you will need?

Base For Examples: DataSet

Data Set with Doubles

UML Diagram Datasets of PointT and BankAccount



Code for DataSetPointT and DataSetBankAccount

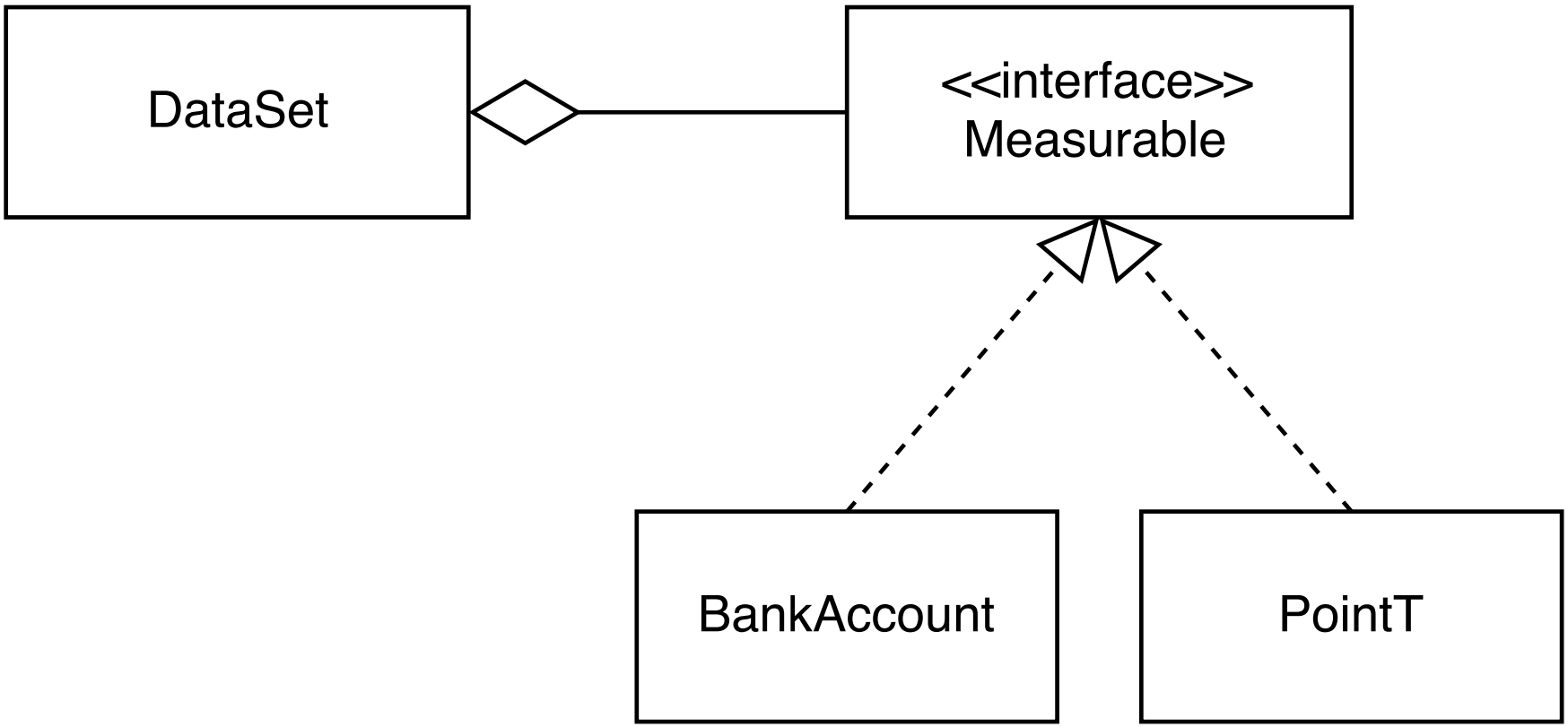
Data Set with PointT

Data Set with BankAccount

Problems

- Inadequate reuse
- Maintenance challenge
- Examples only differ in the measure

UML Diagram of Measurable Interface



- UML diagram can also show interface method names
- Realization arrow is like weak generalization (inheritance)

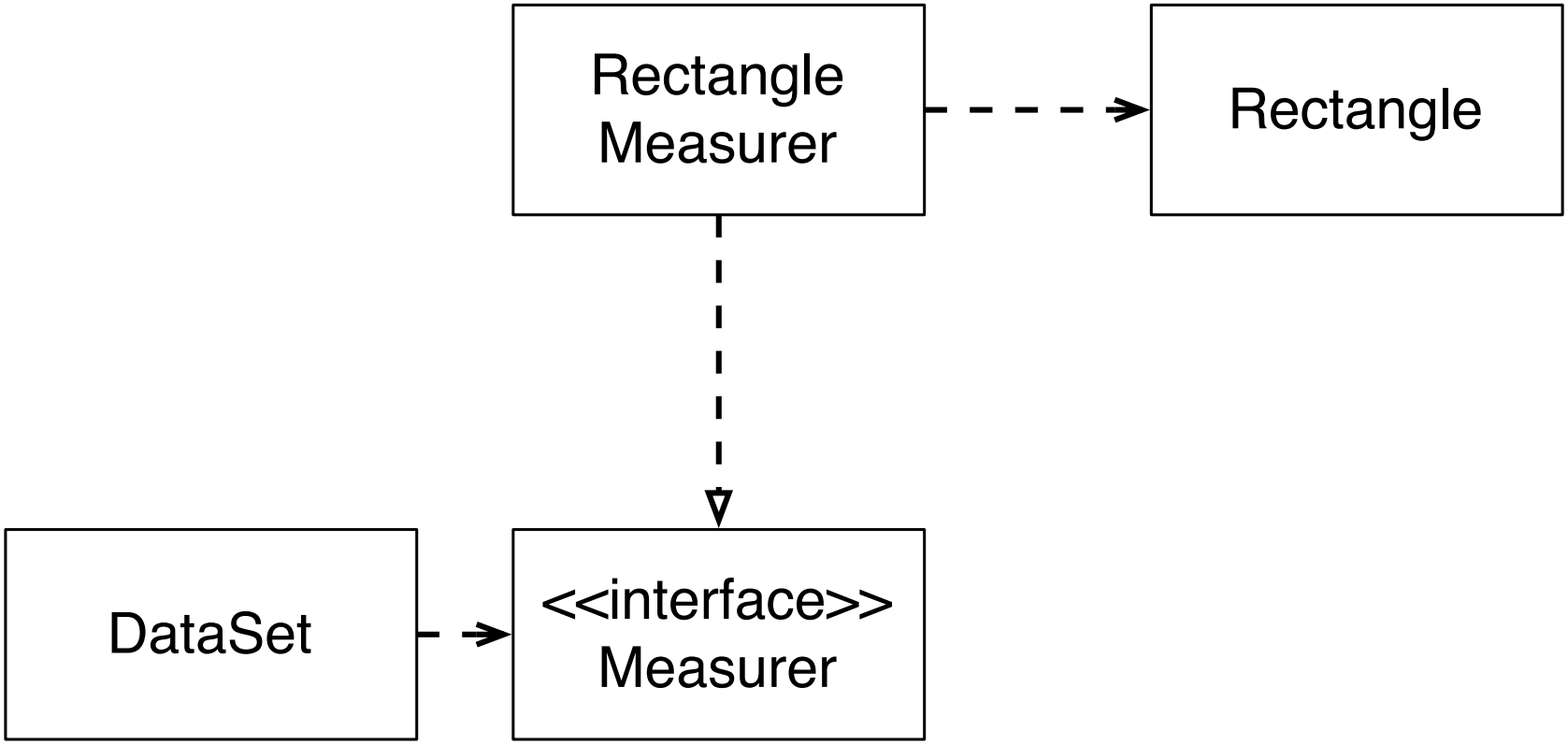
Code For DataSetInterface

Data Set with Measurable Interface

Interface Strategy

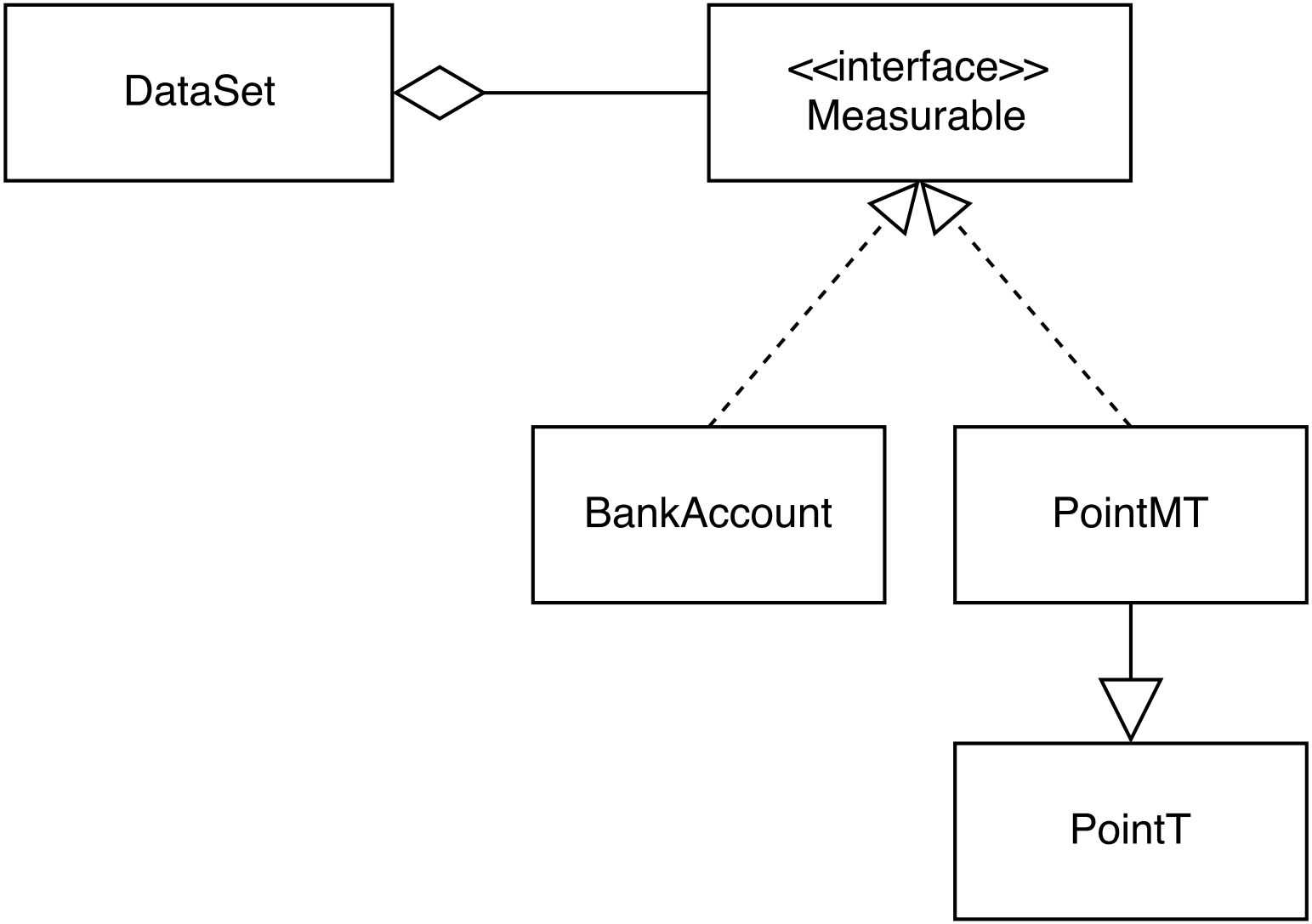
- There are limitations to the Measurable interface
  - You can only add a Measurable interface to classes that you control
  - You can measure an object in only one way
- Move responsibility for measuring outside of objects themselves
- Java
  - Have another object carry out the comparison
  - Introduce a Measurer interface
- C++
  - Multiple inheritance

UML Diagram of Measurer Interface (Java)

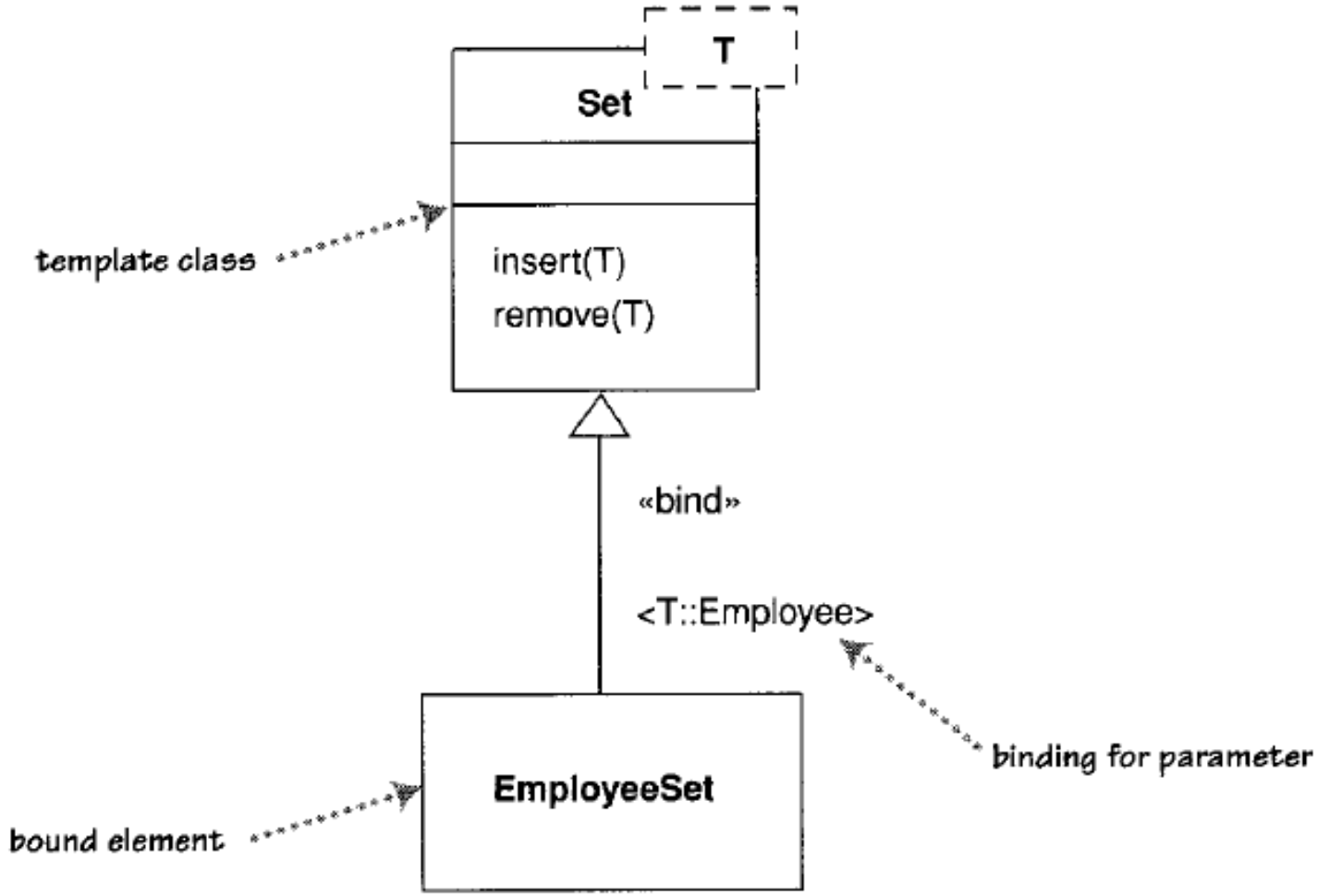


- Rectangle is part of Class java.awt
- You cannot change it

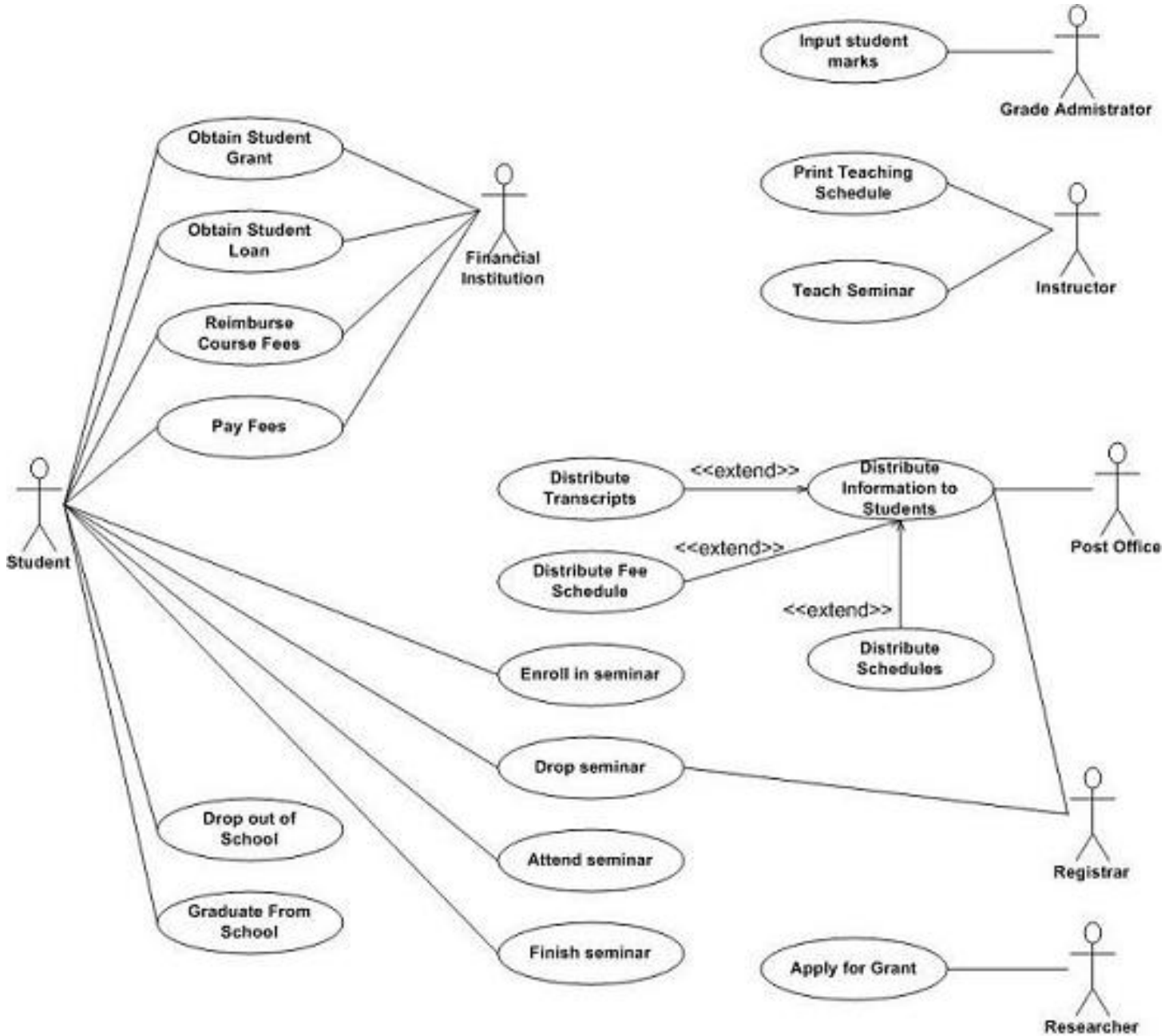
UML Diagram of Multiple Inheritance



UML Diagram for Generic Classes



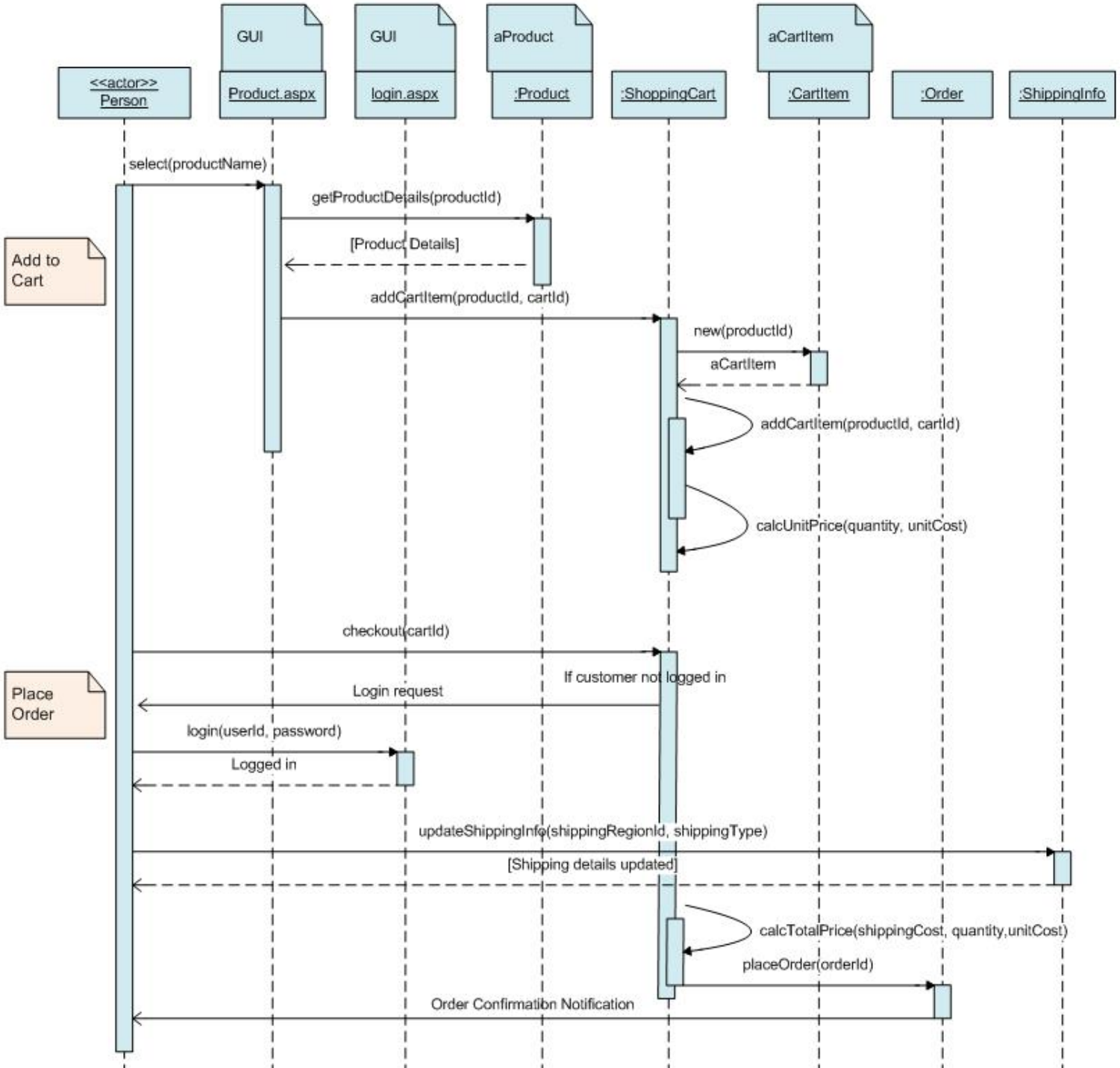
UML Class Diagram Template



UML 2 Use Case Diagrams: An Agile Introduction

Use Cases

- Often used for capturing requirements
- From user's (actor's) viewpoint
  - Person
  - Other system
  - Hardware
  - etc. (anything external
- Each circle is a use case
- Lines represent possible interactions
- An actor represents a role, individuals can take on different roles


GUI
GUI
aProduct
aCartItem
<<actor>>
Person
Product.aspx
login.aspx
:Product
:ShoppingCart
:CartItem
:Order
:ShippingInfo
select(productName)
getProductDetails(productId)
[Product Details]
Add to Cart
addCartItem(productId, cartId)
new(productId)
aCartItem
addCartItem(productId, cartId)
calcUnitPrice(quantity, unitCost)
checkout(cartId)
If customer not logged in
Place Order
Login request
login(userId, password)
Logged in
updateShippingInfo(shippingRegionId, shippingType)
[Shipping details updated]
calcTotalPrice(shippingCost, quantity,unitCost)
placeOrder(orderId)
Order Confirmation Notification

Sequence Diagram Question

- Is a sequence diagram an operational or a descriptive specification?
- If objects exchange a message, should there be an association between their classes?

Sequence Diagrams

- Represents a specific use case scenario
- How objects interact by exchanging messages
- Time progresses in the vertical direction
- The vertically oriented boxes show the object's lifeline