

Template Method Pattern

Prof. Jonathan Lee (李允中)
Department of CSIE
National Taiwan University



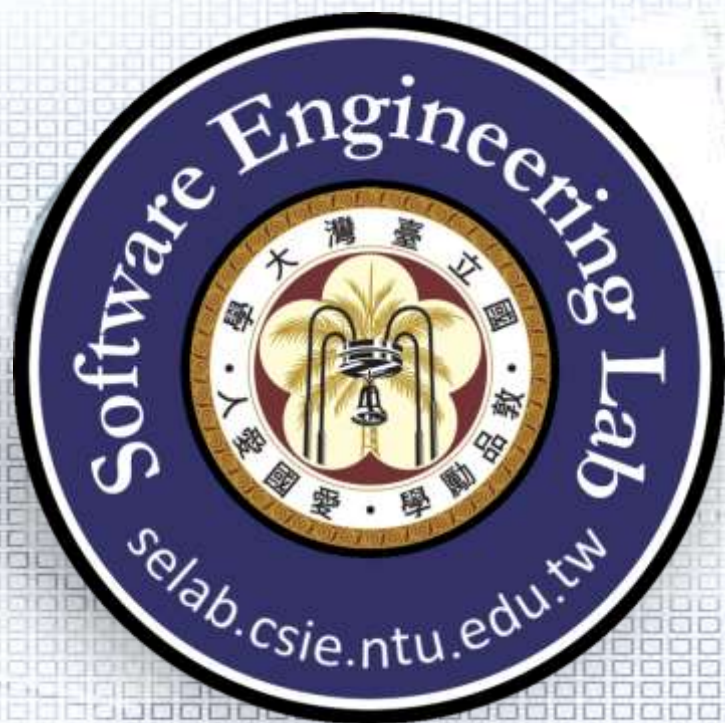
Design Aspect of Template Method

Steps of an algorithm



Outline

- ☐ Requirements Statement
- ☐ Initial Design and Its Problems
- ☐ Design Process
- ☐ Refactored Design after Design Process
- ☐ Another Example
- ☐ Recurrent Problems
- ☐ Intent
- ☐ Template Method Pattern Structure
- ☐ Homework



Opening Documents in Applications (Template)

Prof. Jonathan Lee (李允中)

Department of Computer Science and
Information Engineering
National Taiwan University



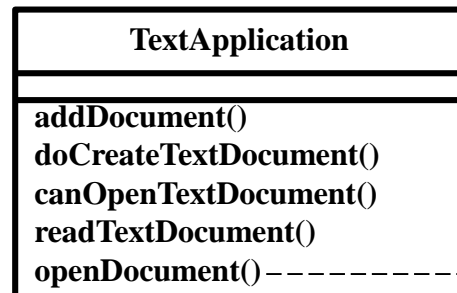
Requirements Statements

- ❑ In order to open a text document, a text application will:
 - Check if the text document can be opened
 - Create a text document object and hold a reference of the text document object.
 - Add the text document object to the Application.
 - Read text document.
- ❑ There is another new requirement.
- ❑ Opening a spreadsheet document with a spreadsheet application carries the same steps in the algorithm (process) as the text document.
 - Check if the spreadsheet document can be opened.
 - Create a spreadsheet document object and hold a reference of the spreadsheet document object.
 - Add the spreadsheet document object to the Application.
 - Read spreadsheet document.



Requirements Statement₁

- ❑ In order to open a text document, a text application will:
 - Check if the text document can be opened
 - Create a text document object and hold a reference of the text document object.
 - Add the text document object to the Application.
 - Read text document.

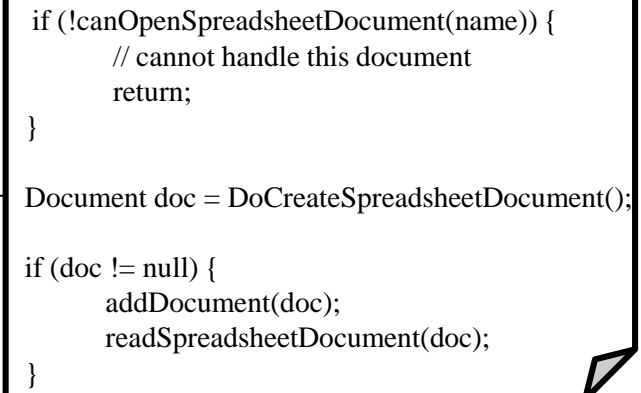
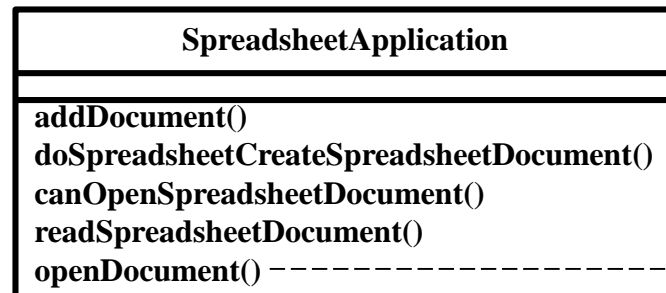


```
if (!canOpenTextDocument(name)) {  
    // cannot handle this document  
    return;  
}  
  
Document doc = DoCreateTextDocument();  
  
if (doc != null) {  
    addDocument(doc);  
    readTextDocument(doc);  
}
```



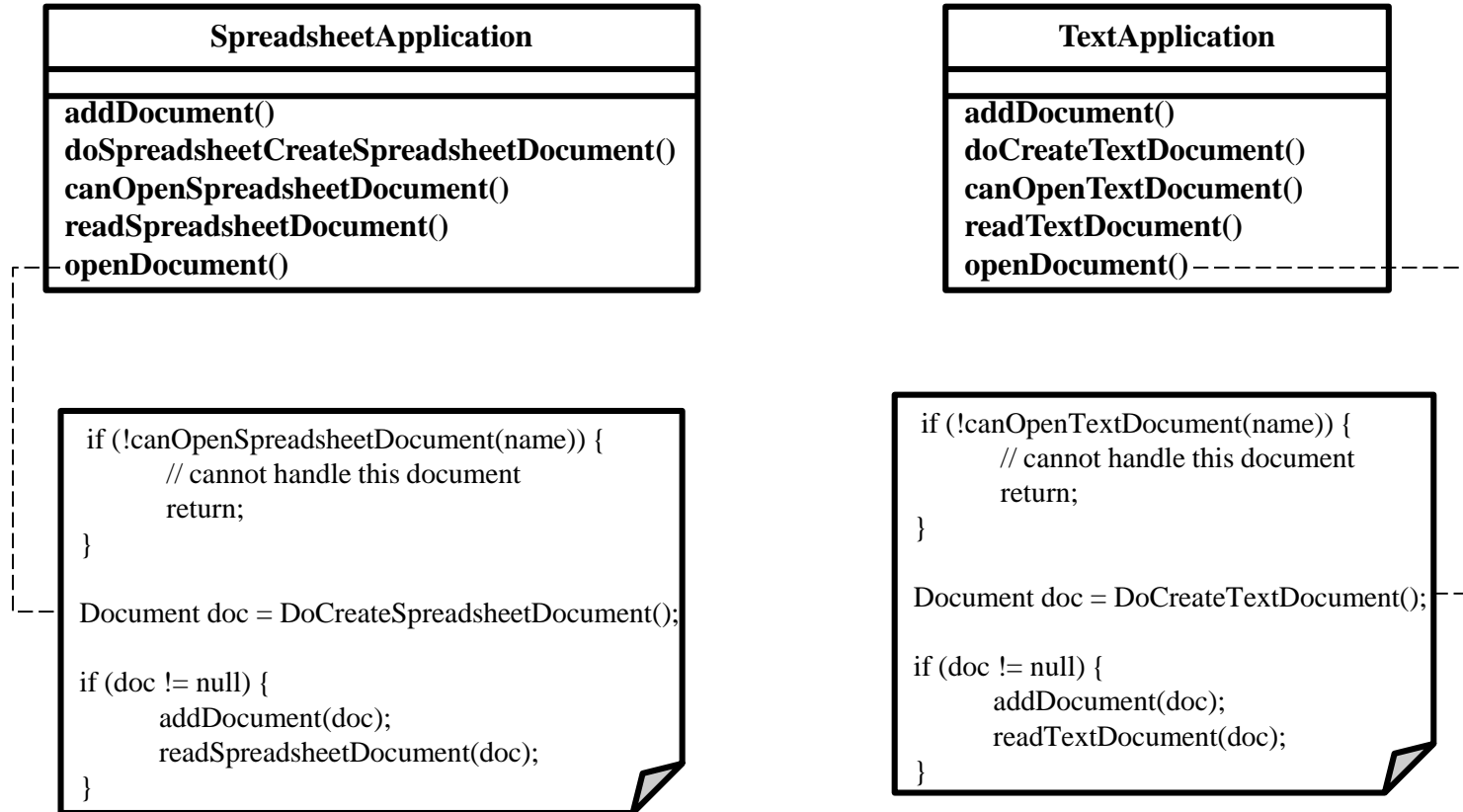
Requirements Statement₂

- ❑ There is another new requirement.
- ❑ Opening a spreadsheet document with a spreadsheet application carries the same steps in the algorithm (process) as the text document.
 - Check if the spreadsheet document can be opened.
 - Create a spreadsheet document object and hold a reference of the spreadsheet document object.
 - Add the spreadsheet document object to the Application.
 - Read spreadsheet document.





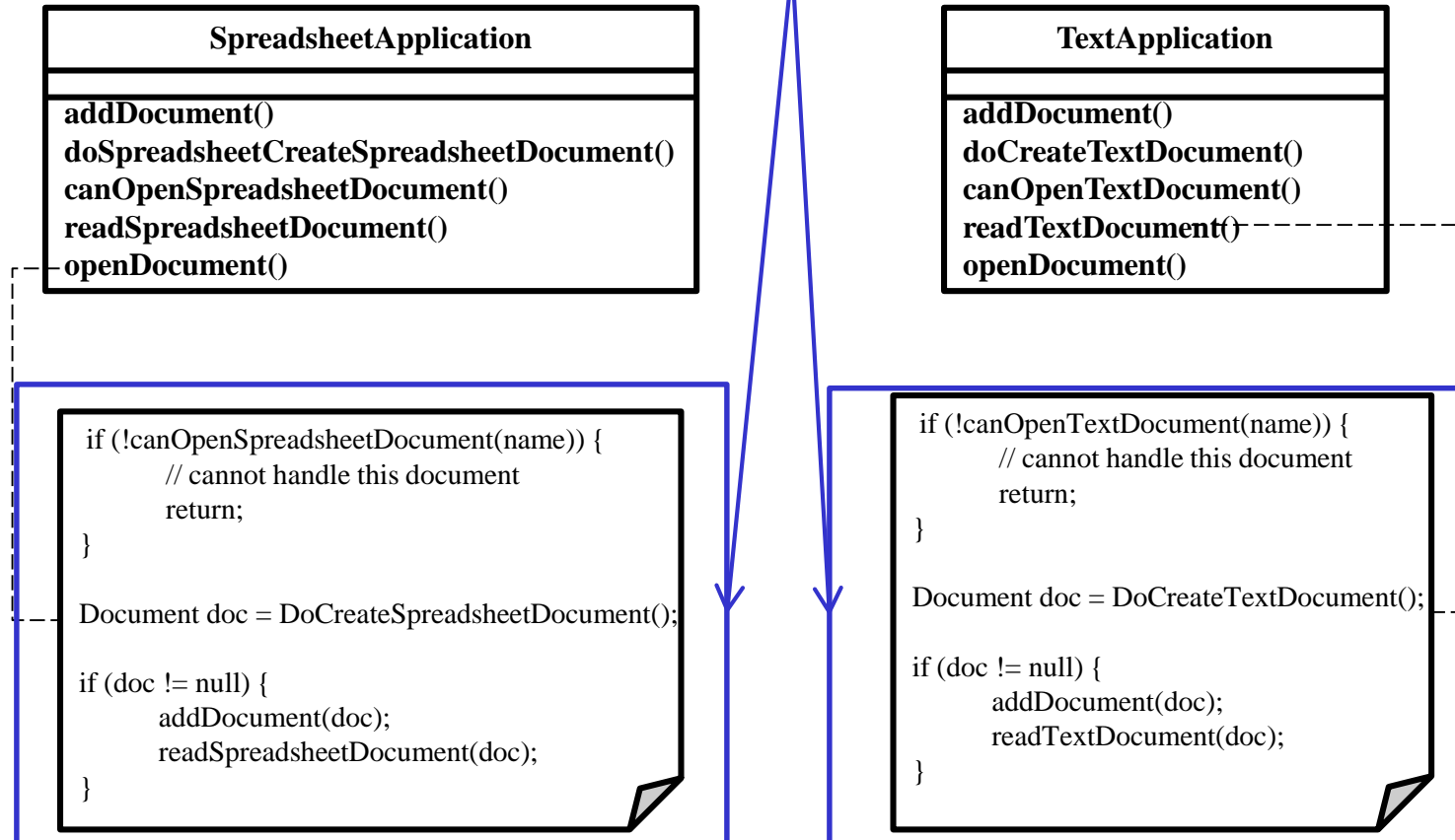
Initial Design





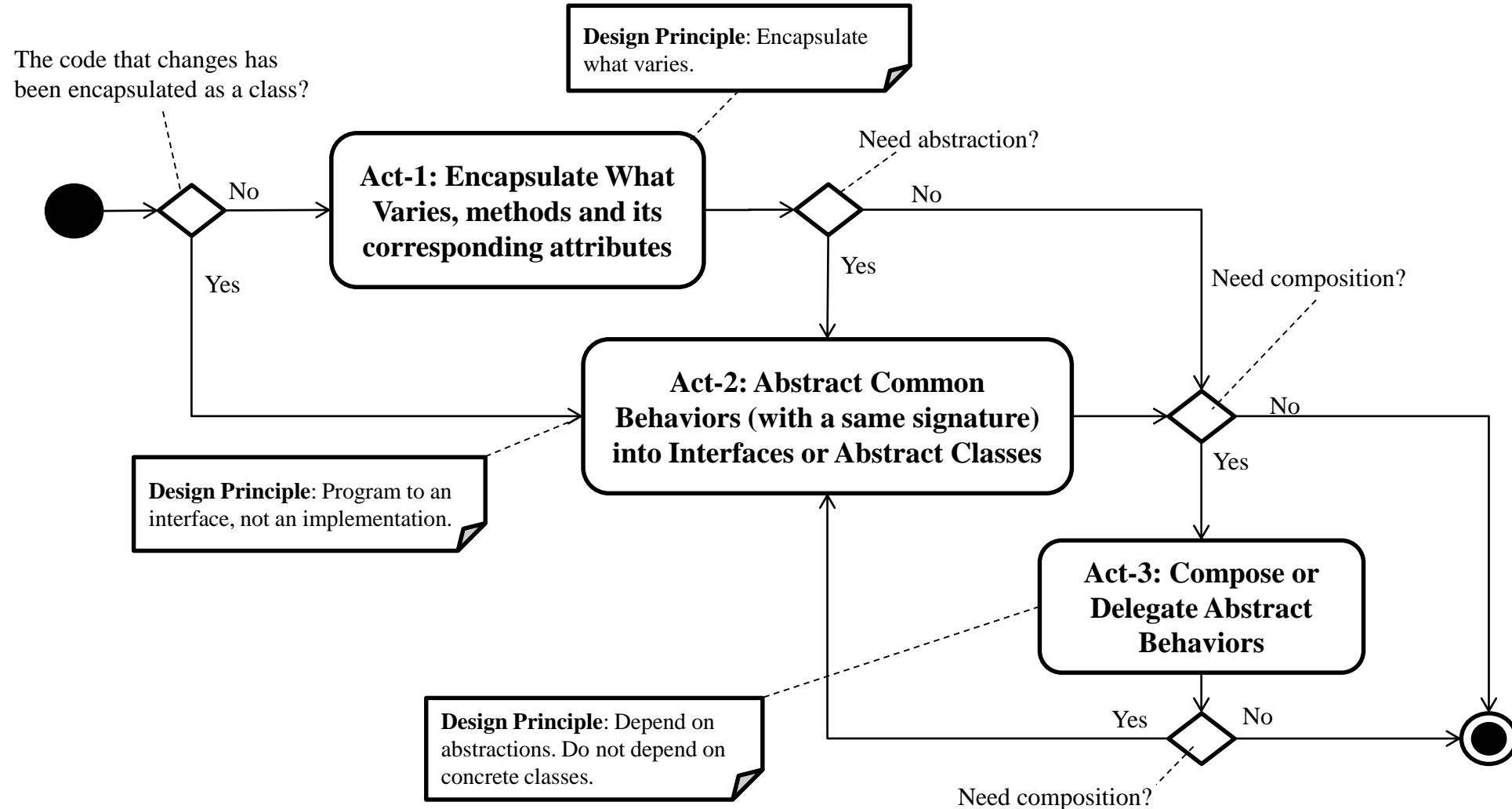
Problem with the Initial Design

Problem: Both the SpreadsheetApplication and TextApplication classes will be modified if the algorithm (duplicate code) of opening spreadsheet and text is changed.





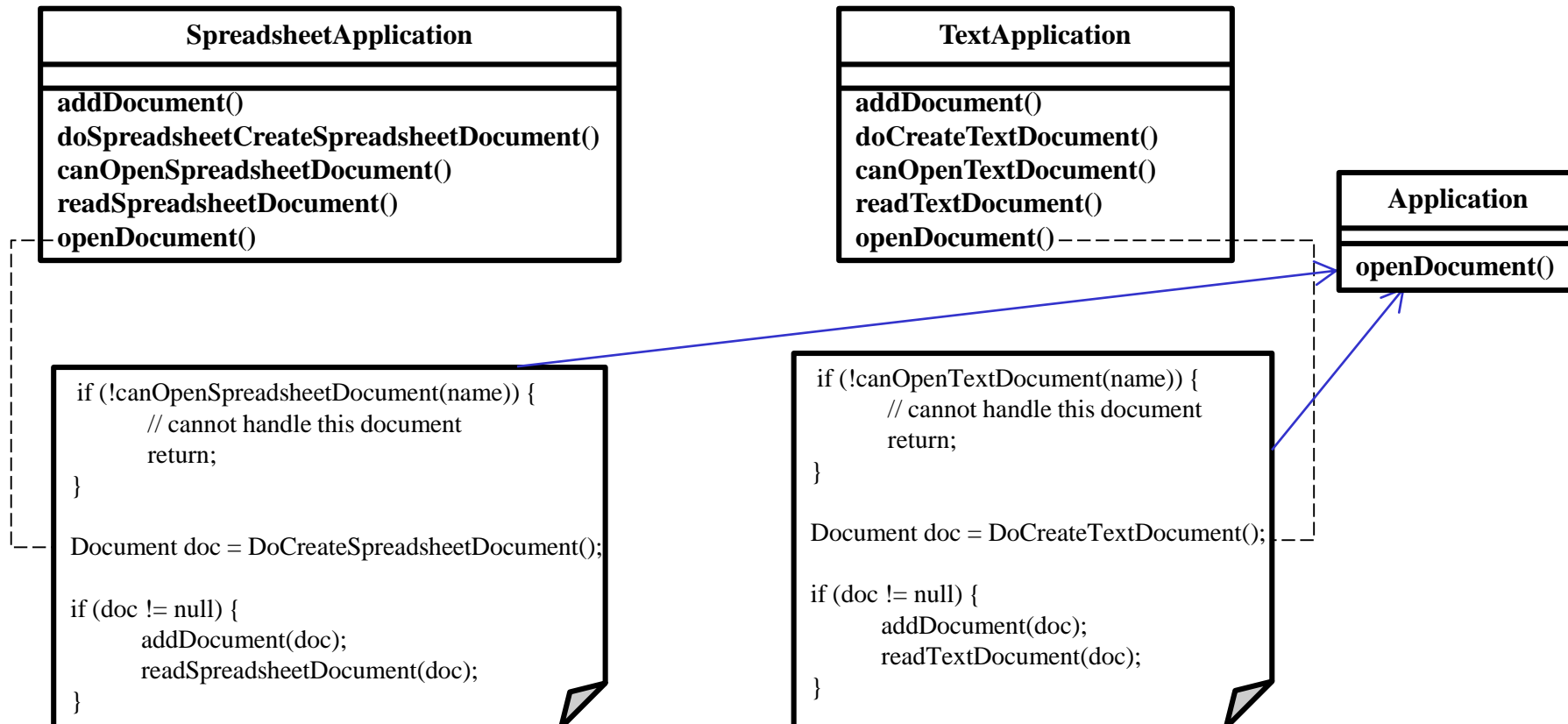
Design Process for Change





Act-1: Encapsulate What Varies

Act-1.2: Encapsulate a method (an interchangeable behavior) into a concrete class

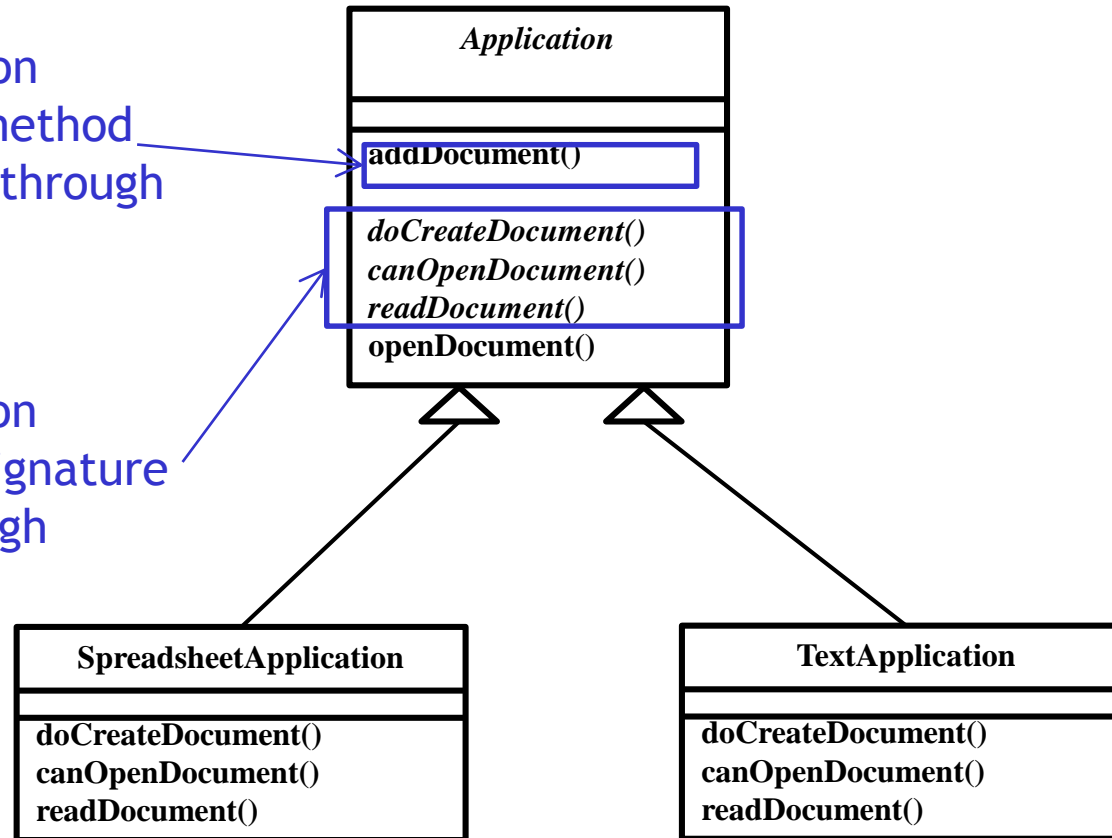




Act-2: Abstract Common Behaviors

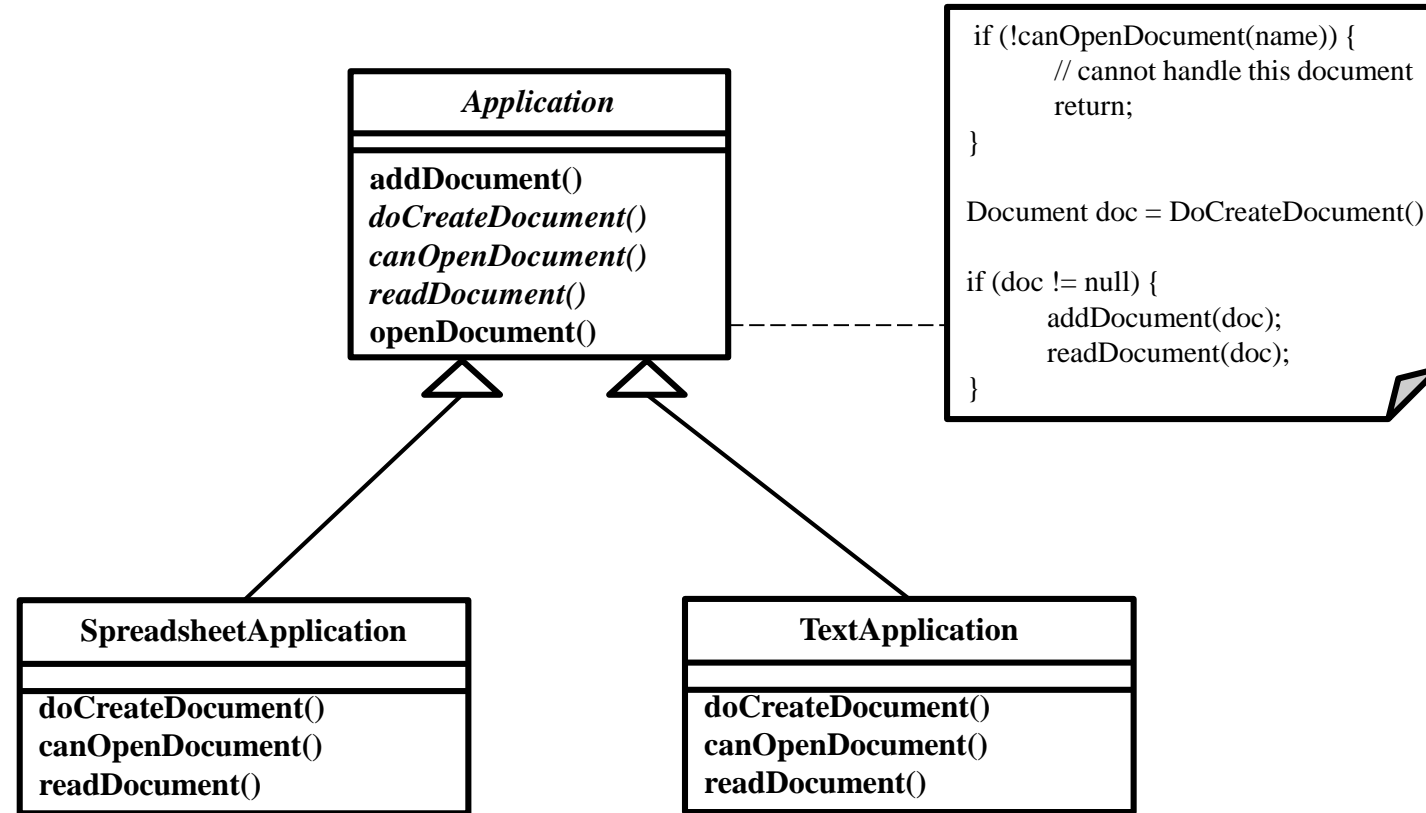
Act-2.3: Abstract common behaviors with a same method body into abstract class through inheritance

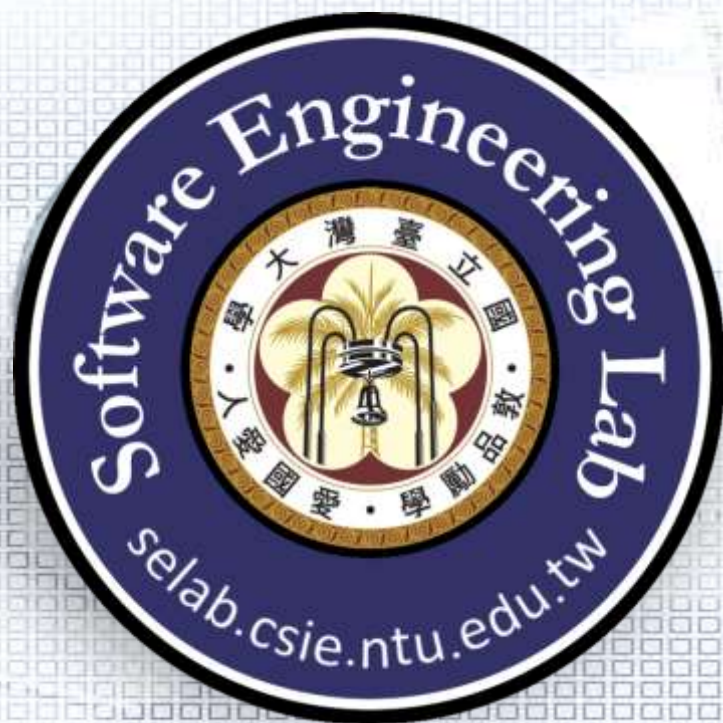
Act-2.2: Abstract common behaviors with a same signature into abstract class through inheritance





Final Design





Prepare Caffeine Beverages (Template Method)

Prof. Jonathan Lee (李允中)

Department of Computer Science and
Information Engineering
National Taiwan University



Requirements Statements

- ❑ Please follow these recipes precisely when preparing Starbuzz beverages
 - Starbuzz Coffee Recipe
 - Boil some water
 - Brew coffee in boiling water
 - Pour Coffee in cup
 - Add sugar and milk
- ❑ Please follow these recipes precisely when preparing Starbuzz beverages
 - Starbuzz Tea Recipe
 - Boil some water
 - Steep tea in boiling water
 - Pour tea in cup
 - Add lemon

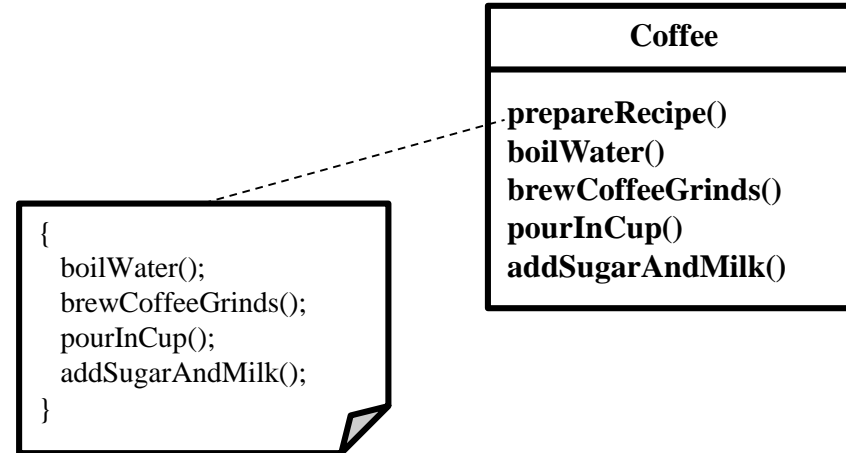


Requirements Statement₁

❑ Please follow these recipes precisely when preparing Starbuzz beverages

➤ Starbuzz Coffee Recipe

- Boil some water
- Brew coffee in boiling water
- Pour Coffee in cup
- Add sugar and milk



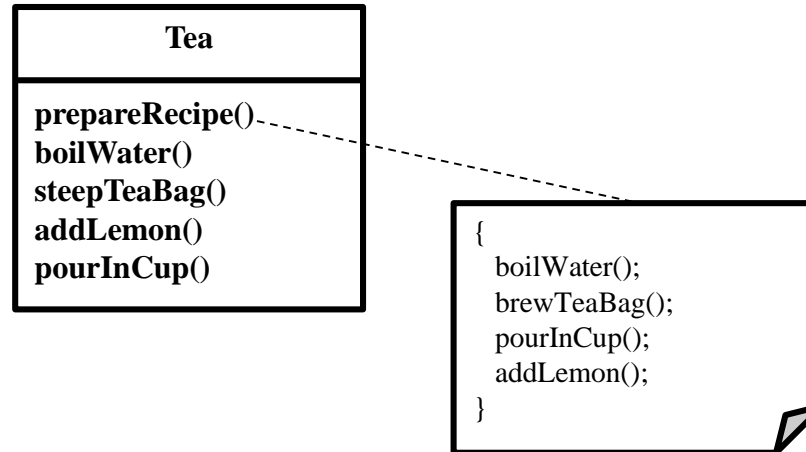


Requirements Statement₂

❑ Please follow these recipes precisely when preparing Starbuzz beverages

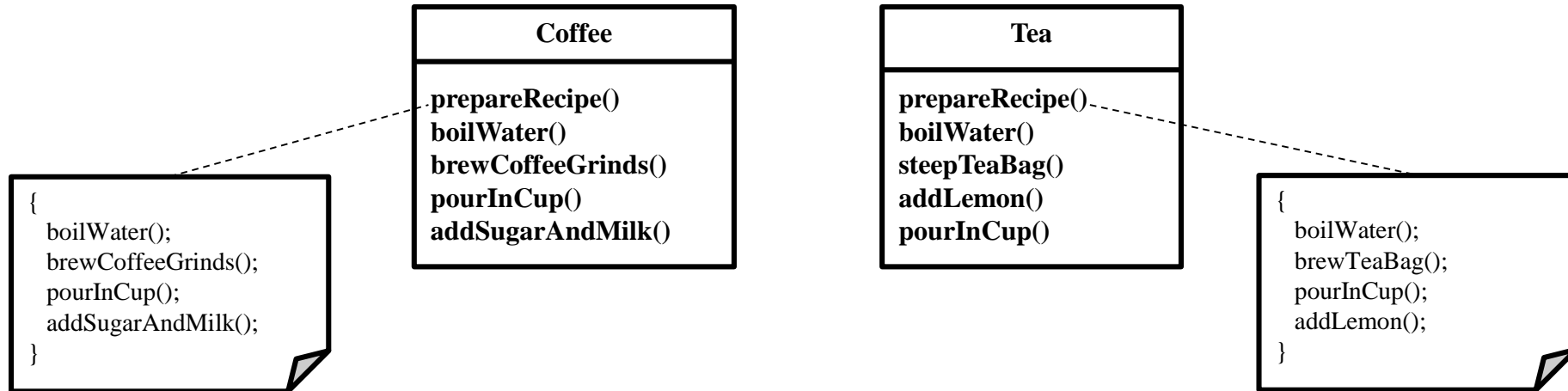
➤ Starbuzz Tea Recipe

- Boil some water
- Steep tea in boiling water
- Pour tea in cup
- Add lemon



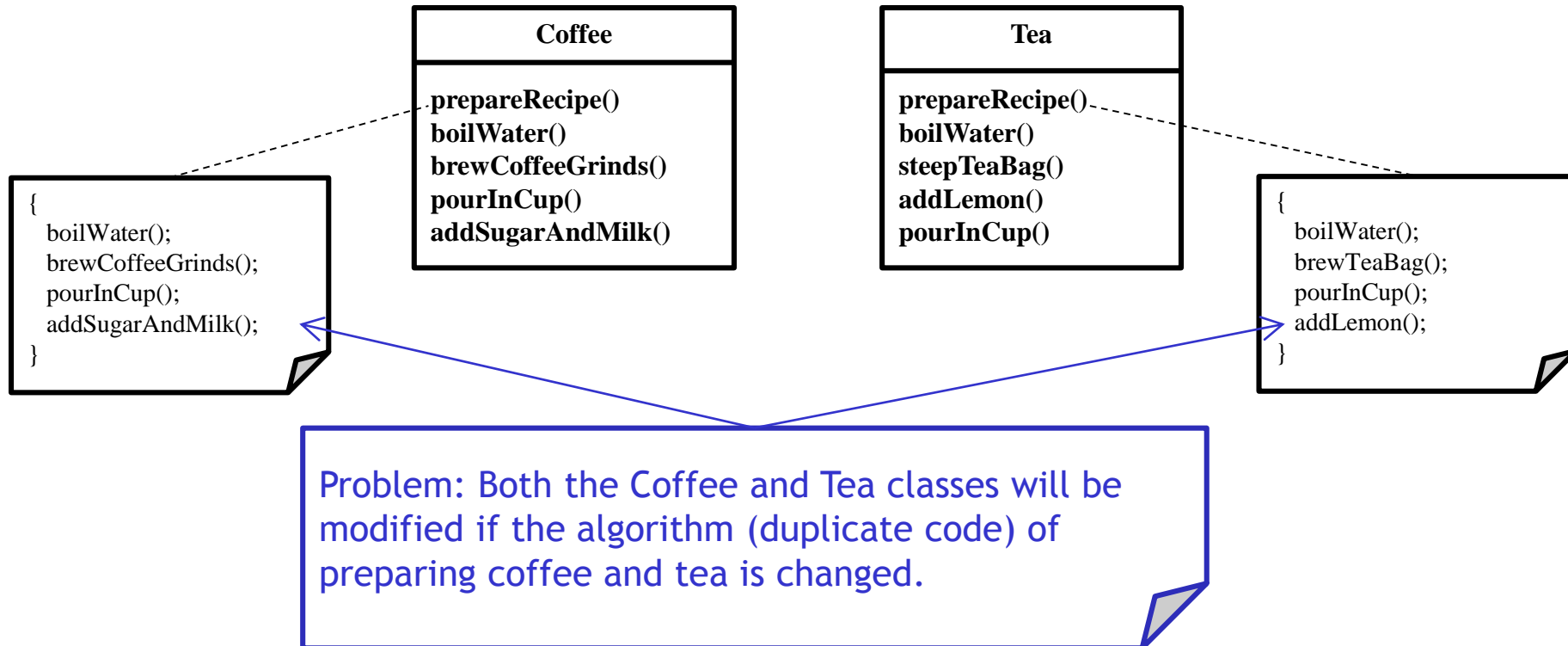


Initial Design - Class Diagram



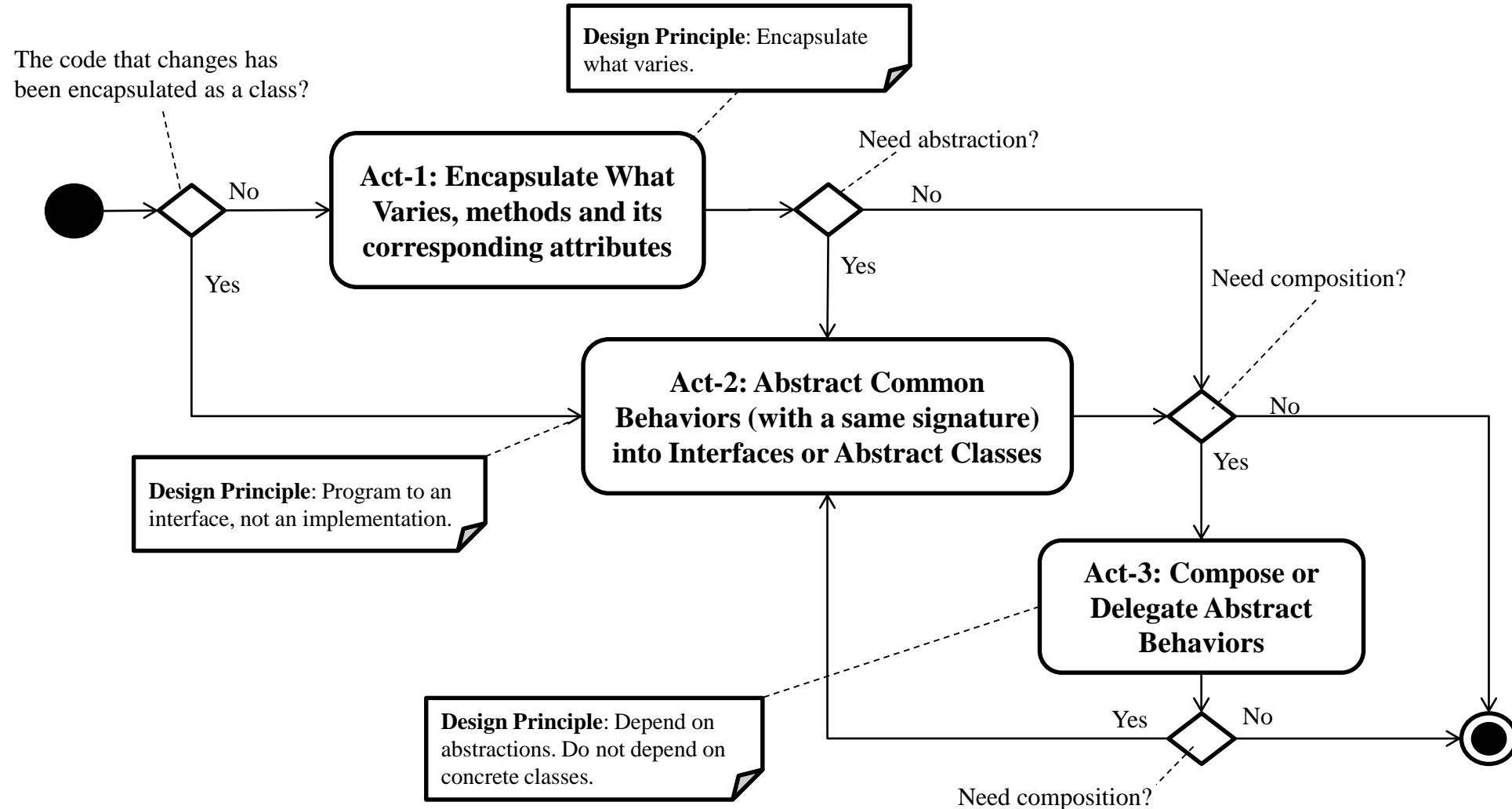


Problems with Initial Design



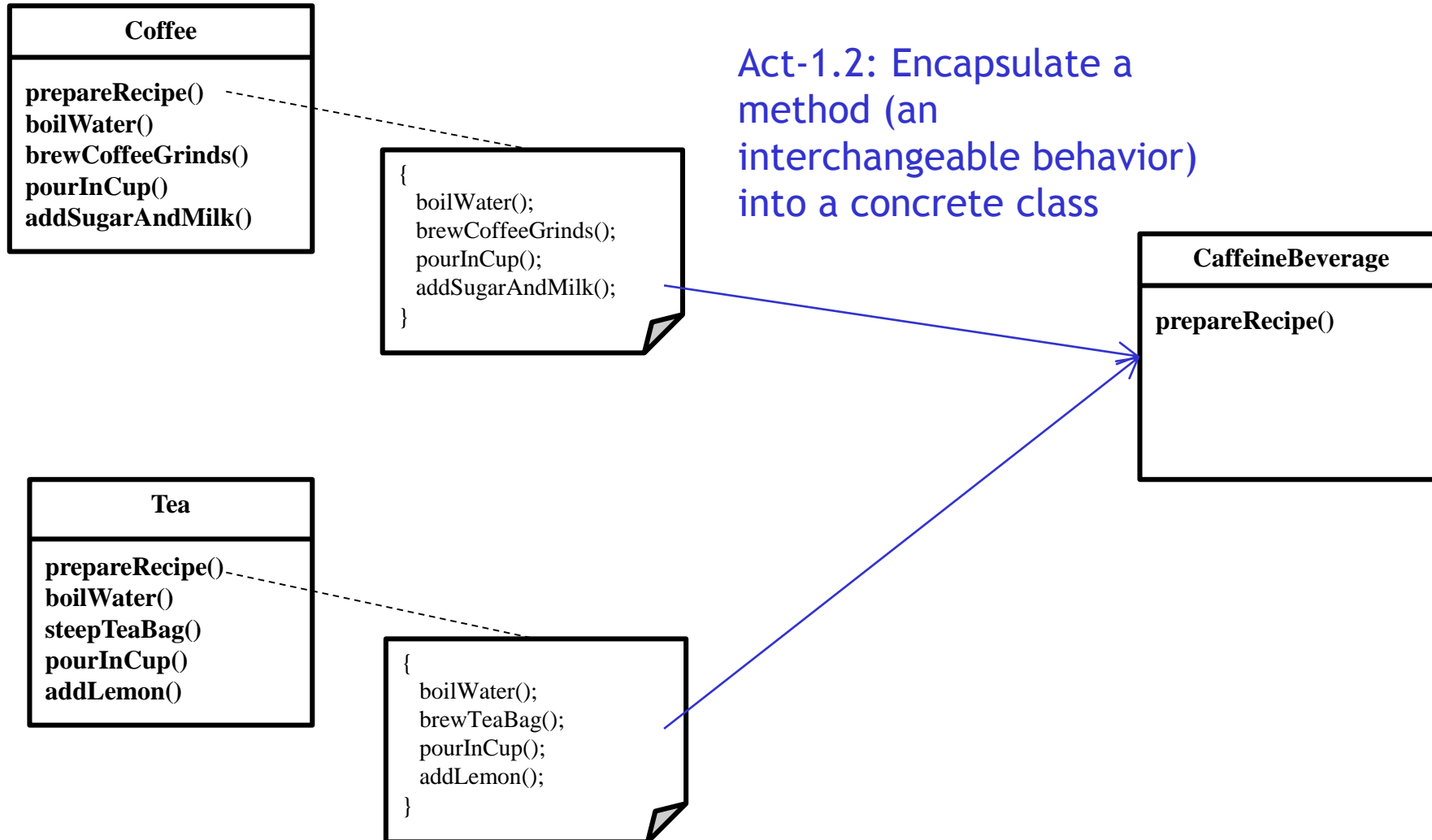


Design Process for Change



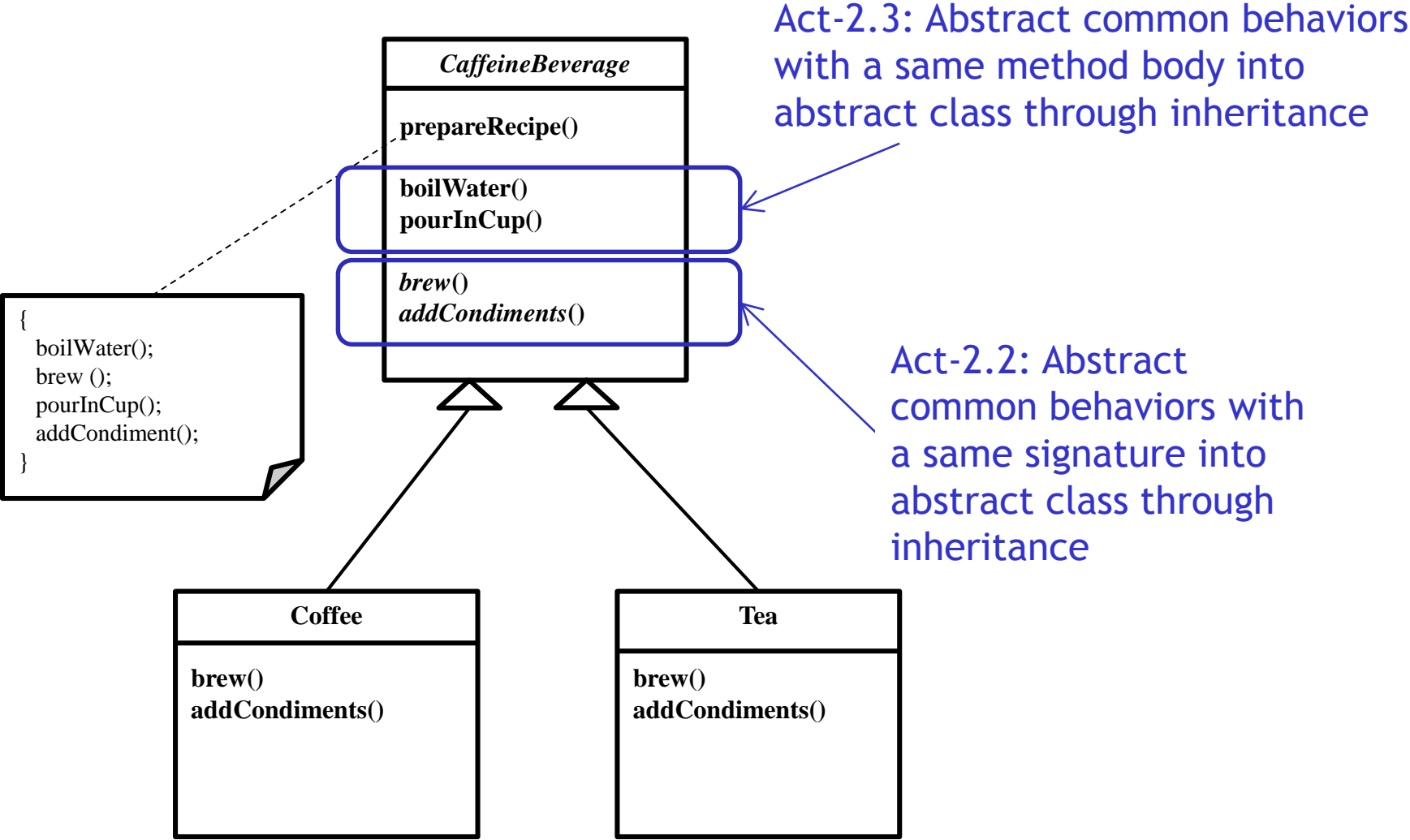


Act-1: Encapsulate What Varies



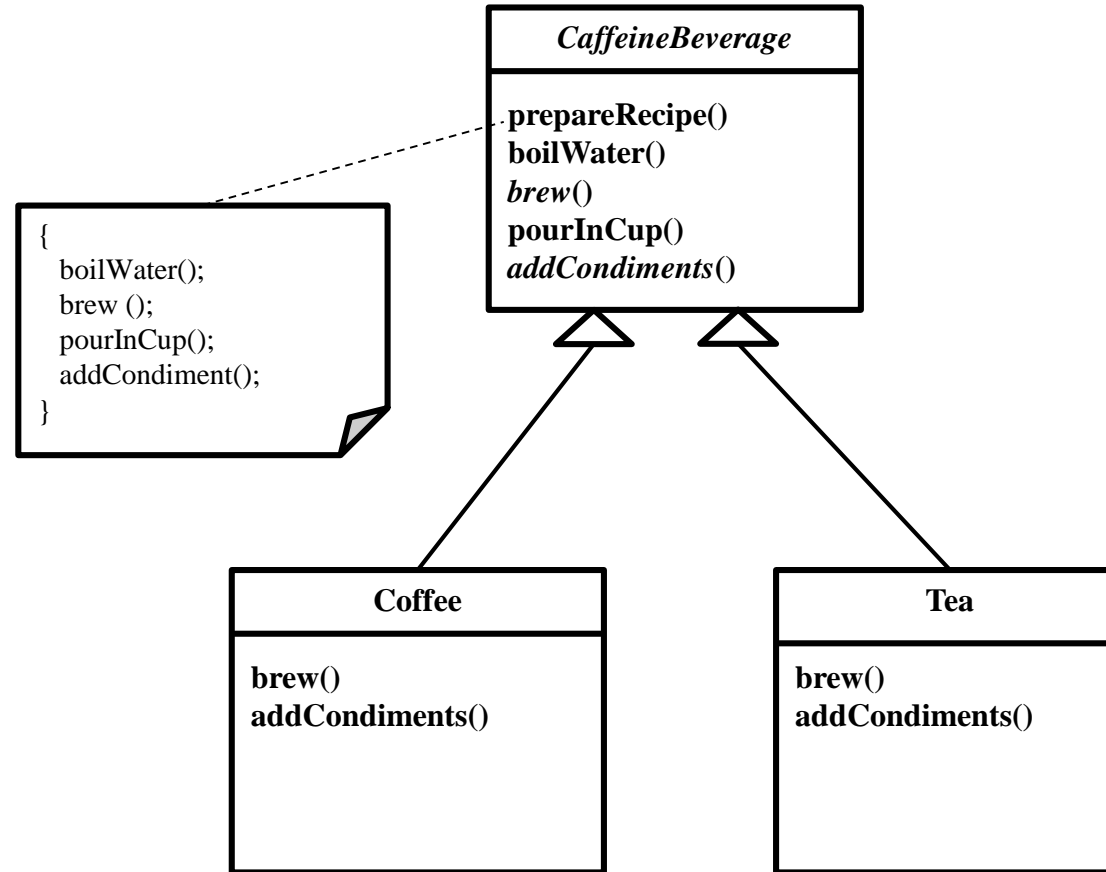


Act-2: Abstract Common Behaviors





Refactored Design after Design Process





Recurrent Problem

- ❑ Two classes with code duplications would be modified at the same time if the duplicate code is being changed.

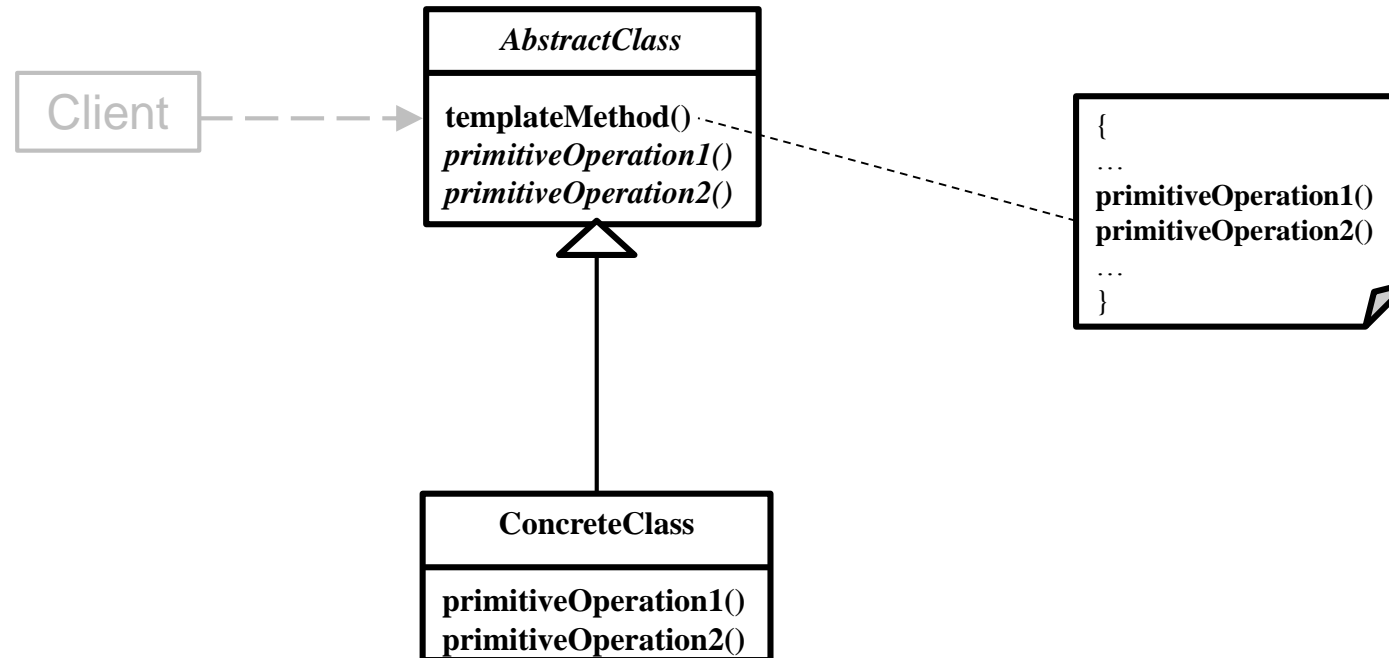


Intent

- ☐ Define the skeleton of an algorithm in an operation, deferring some steps to subclasses.
- ☐ Template Method lets subclasses redefine certain steps of an algorithm without changing the algorithm's structure.

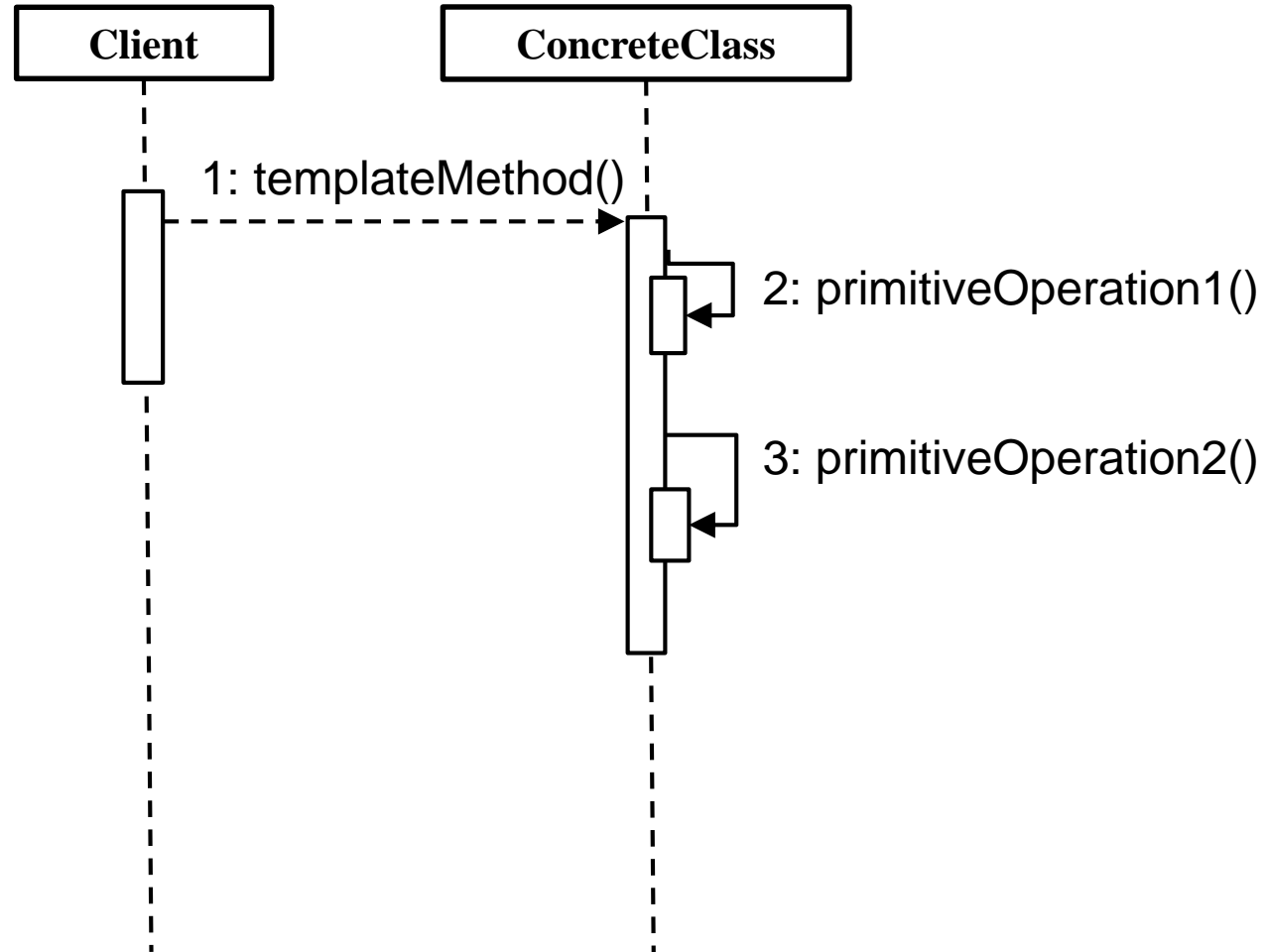


Template Pattern Structure₁





Template Pattern Structure₂





Template Pattern Structure₃

	Instantiation	Use	Termination
Abstract Class	Don't Care	Client class uses this abstract class to execute steps of an algorithm through polymorphism	Don't Care
Concrete Class	Client	Client class uses this class to execute steps of an algorithm through abstract class	Don't Care