CS 485
Advanced Object Oriented Design

Factories (ch 20 & 23 & 11 & 24)

Spring 2017

http://www.netobjectives.com/PatternRepository/index.php?title=PatternsByAlphabet

http://www.netobjectives.com/files/books/dpe/design-patterns-matrix.pdf

Make sure you get the Strategy Lab to work (only get my files to work, you don't need to add any other fill strategies).

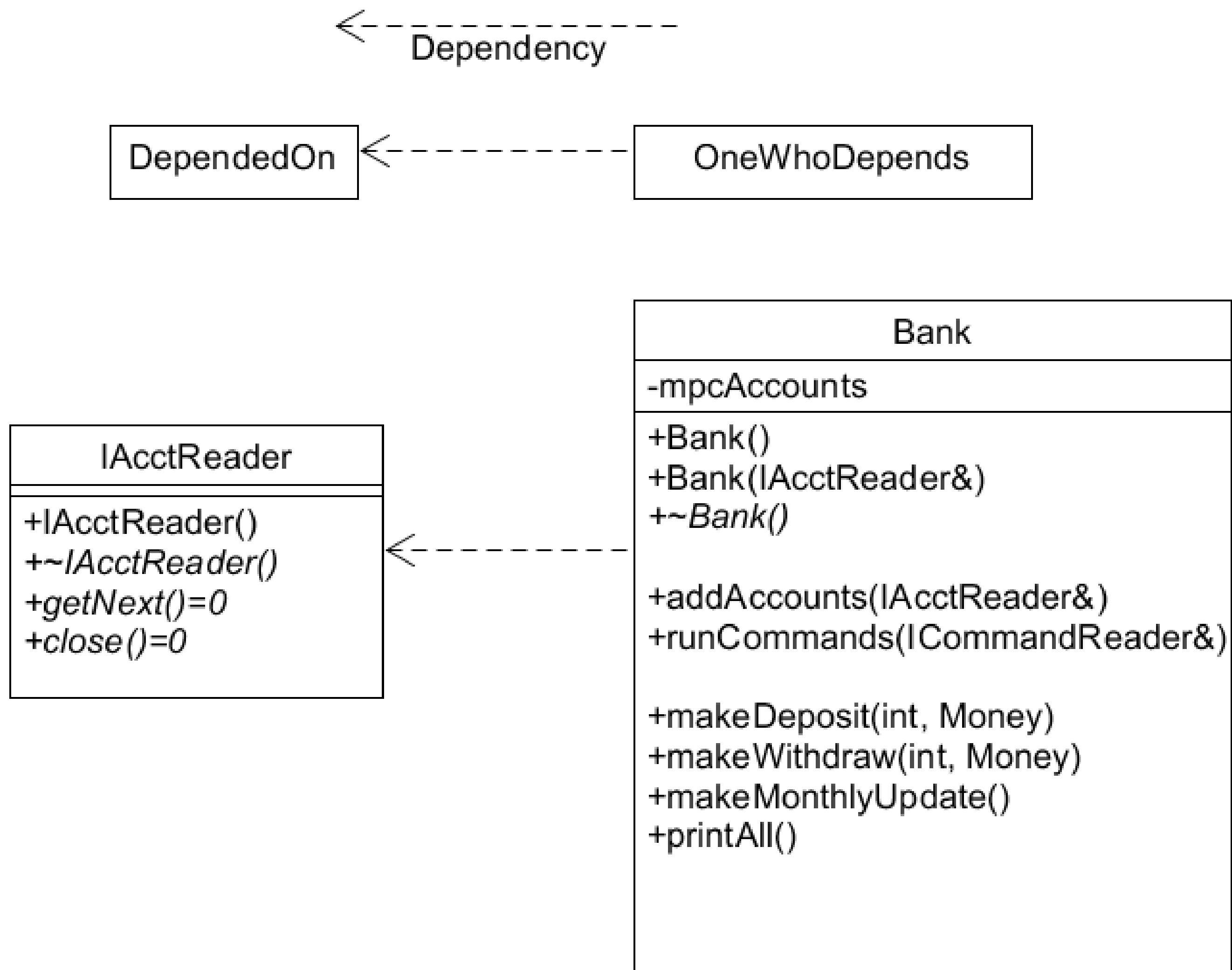
Release the finished Lab as StrategyLab by Friday, 3:30pm

10 pts

Review - Patterns

- Creational
  - Factories
- Behavioral
  - Command
  - **Strategy**
  - **Template Method**
- Structural
  - **Facade**

UML Update



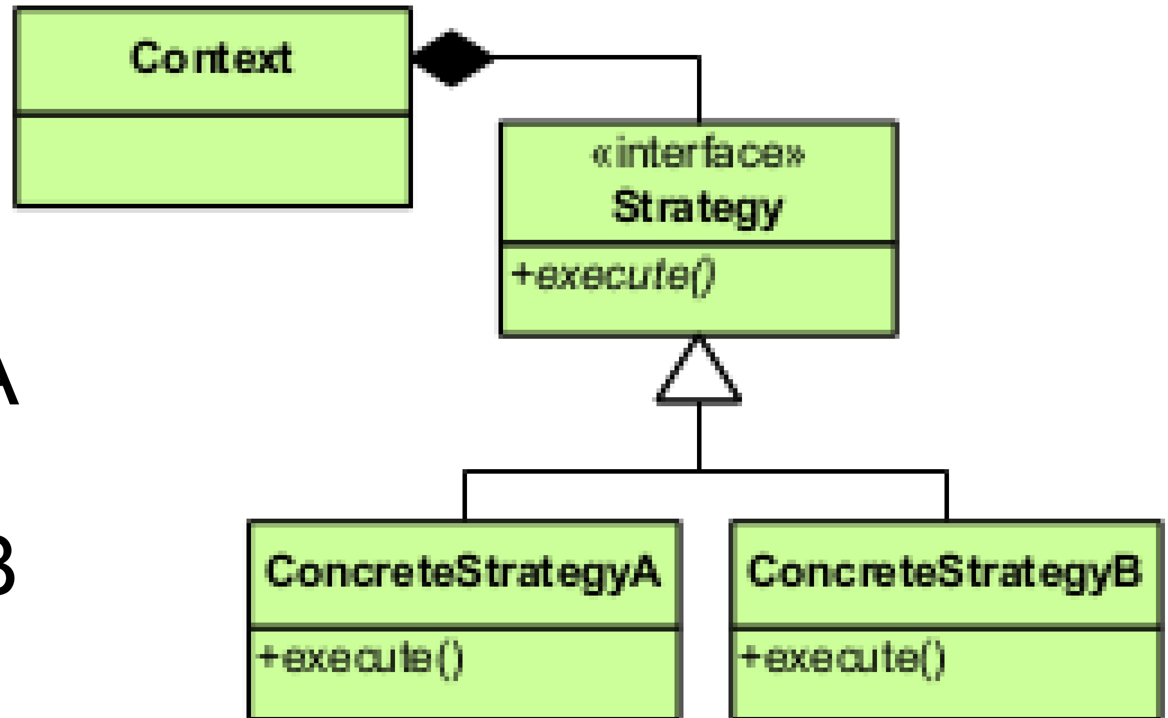
Factories

- Chapter 20 - Overview
- Chapter 23 - Factory Method
- Chapter 11 - Abstract Factories
- Chapter 24 - Summary

- "Objects that make other objects" - Shalloway
- Decouple the creation of objects from the client
  - hide creation details
  - hide concrete classes
  - *allow subclasses to decide how and which concrete classes to instantiate*

Motivation

- Strategy Pattern
- Context knows nothing about ConcreteStrategyA or ConcreteStrategyB
- Who creates the concrete Strategy?
- Could be a Factory!



Guidelines

- Define objects and how they work together
- Write factories that instantiate the correct objects for the right situtation...
- An object should either
  - **make/manage** other objects

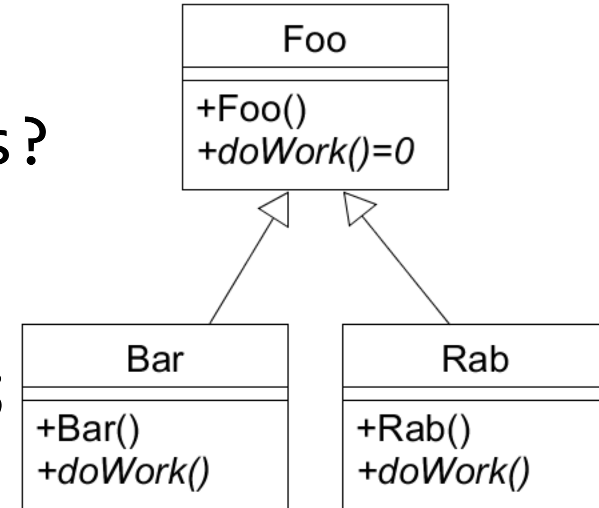
    OR
  - **use** other objects

Shalloway, p 351

Factory Method

- Single method that creates objects
  - may take a parameter to determine which class to instantiate
- Where does the method live?
  - public static method in a Factory class
  - public static method in the *parent* class
  - private method in a Creator class

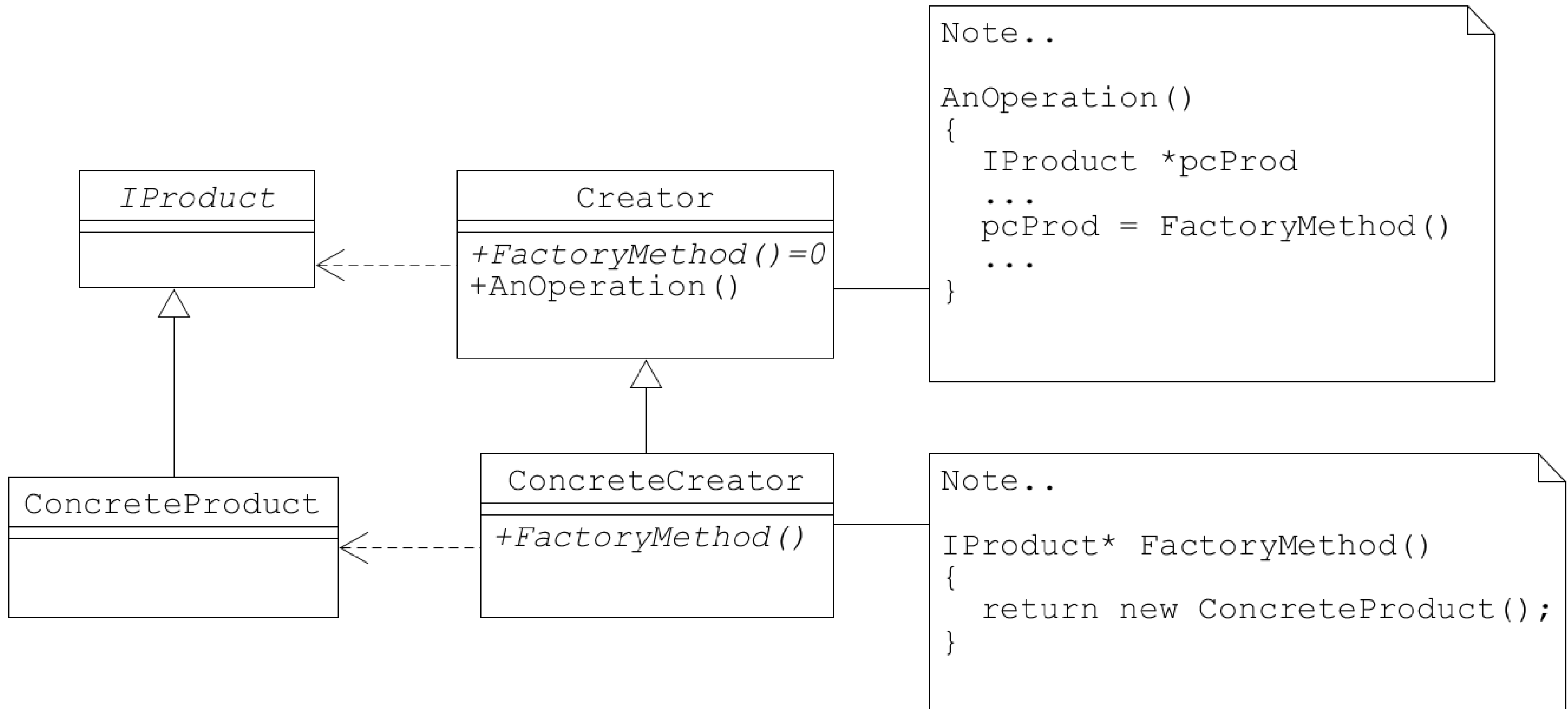
Options you might see in real life




```
class FooFactory // Problems? Benefits?
{
  public:
    static Foo* makeFoo(char fooType);
};
```

```
class Foo // Problems? Benefits? SOLID?
{
  public:
    static Foo* makeFoo(char fooType);
  ...
};
```

Basic Factory Method Pattern

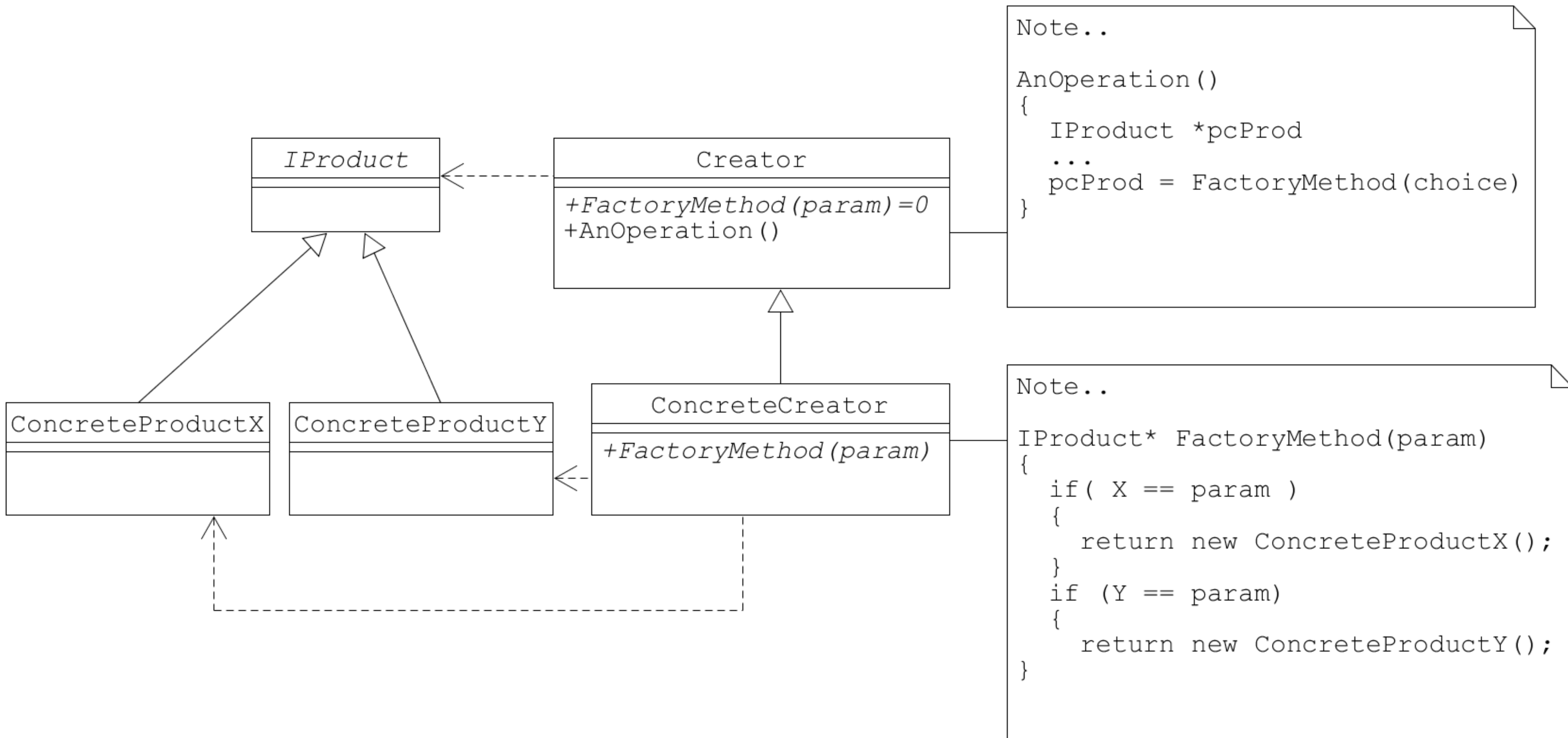



```
// Problems? Benefits? Advantages? SOLID?
```

Note: AnOperation() could be a Template Method.

Shalloway, p 389

Parameterized Factory Method



Example

- Add default constructors
  - Shape
  - Circle
  - Square
  - Color
- Add IShapesDataBase
  - abstract parent class for ShapesDataBase
- Add Virtual Friend Idiom to Shape heirarchy
  - I explained this backwards Friday. See next slide.

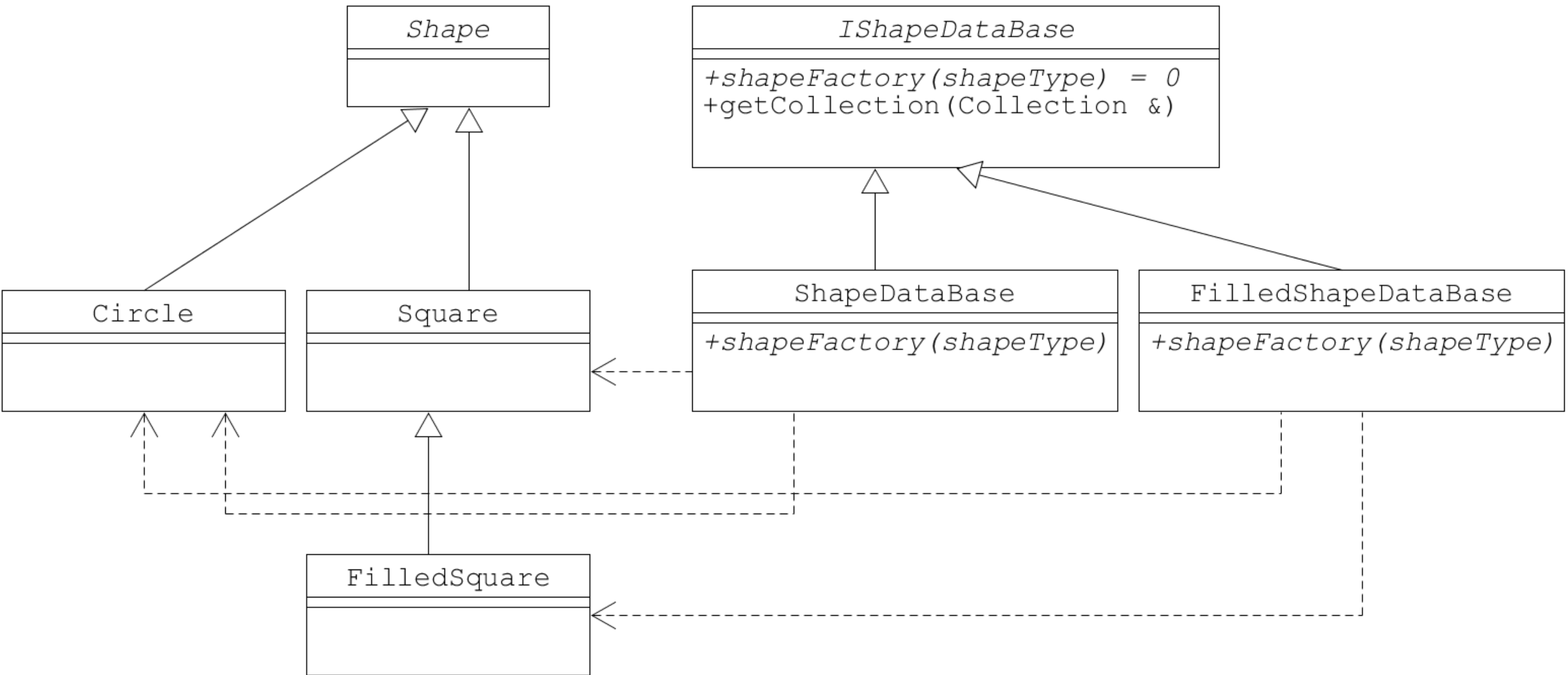
ShapeDataBase
-mTheData
+ShapeDataBase() +~ShapeDataBase() +openDatabase(filename) +closeDatabase() +getCollection(Collection&)

Virtual Friend Idiom

```
void Circle::read (std::istream &rcIn) // virtual
{
  Shape::read (rcIn);
  rcIn >> mRadius;

}

std::istream & operator >> (std::istream & rcIn, Circle & rcCircle)
{
  rcCircle.read (rcIn);
  return rcIn;
}
```

https://en.wikibooks.org/wiki/More_C%2B%2B_Idioms/Virtual_Friend_Function

Example



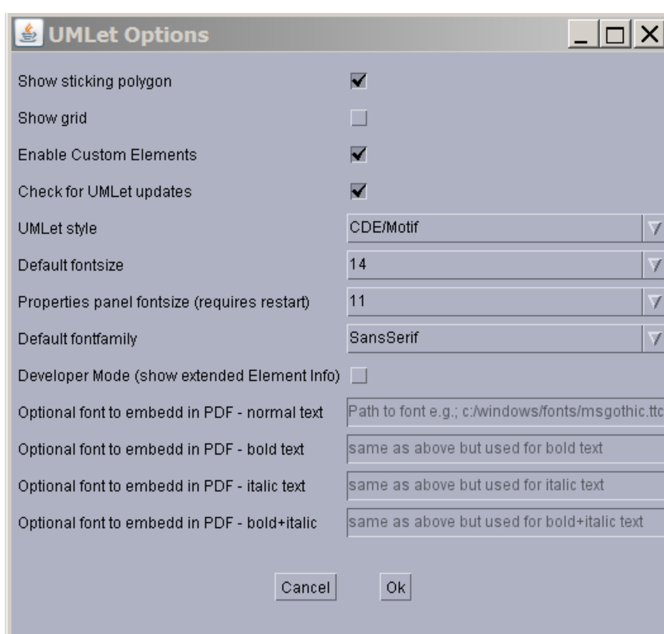
// IShapeDataBase contains many other methods

```cpp
Shape* ShapeDataBase::shapeFactory (char shapeType)
{
  Shape *pcShape = nullptr;

  switch (shapeType)
  {
  case 'S':
    pcShape = new Square ();
    break;
  case 'C':
    pcShape = new Circle ();
    break;
  }
  return pcShape;
}
```

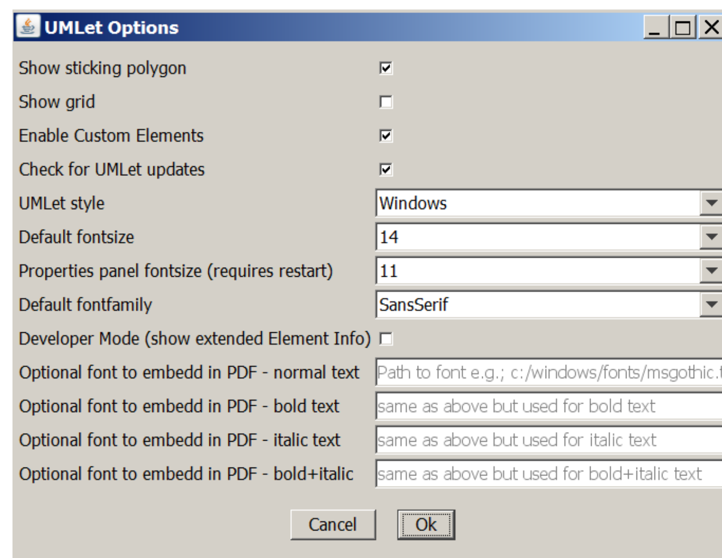
```cpp
void ShapeDataBase::getCollection (Collection & rcCollection)
{
  char shapeType;
  Shape *pcShape;

  while (mTheData >> shapeType)
  {
    pcShape = shapeFactory (shapeType);
    if (nullptr != pcShape)
    {
      mTheData >> *pcShape;
      rcCollection.addShape (pcShape);
    }
  }
}
```

Abstract Factory Pattern

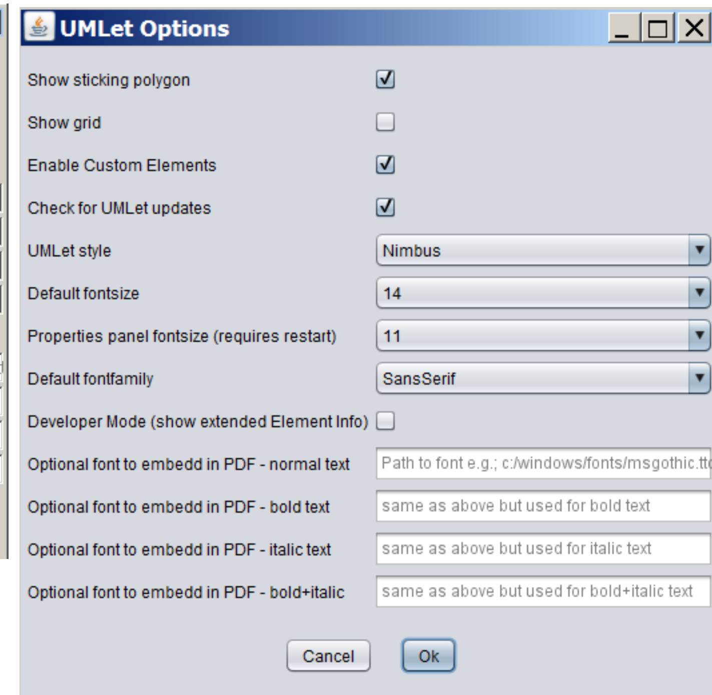
- One abstract factory class for an interface
- A set of concrete factories
  - each factories makes a family of objects



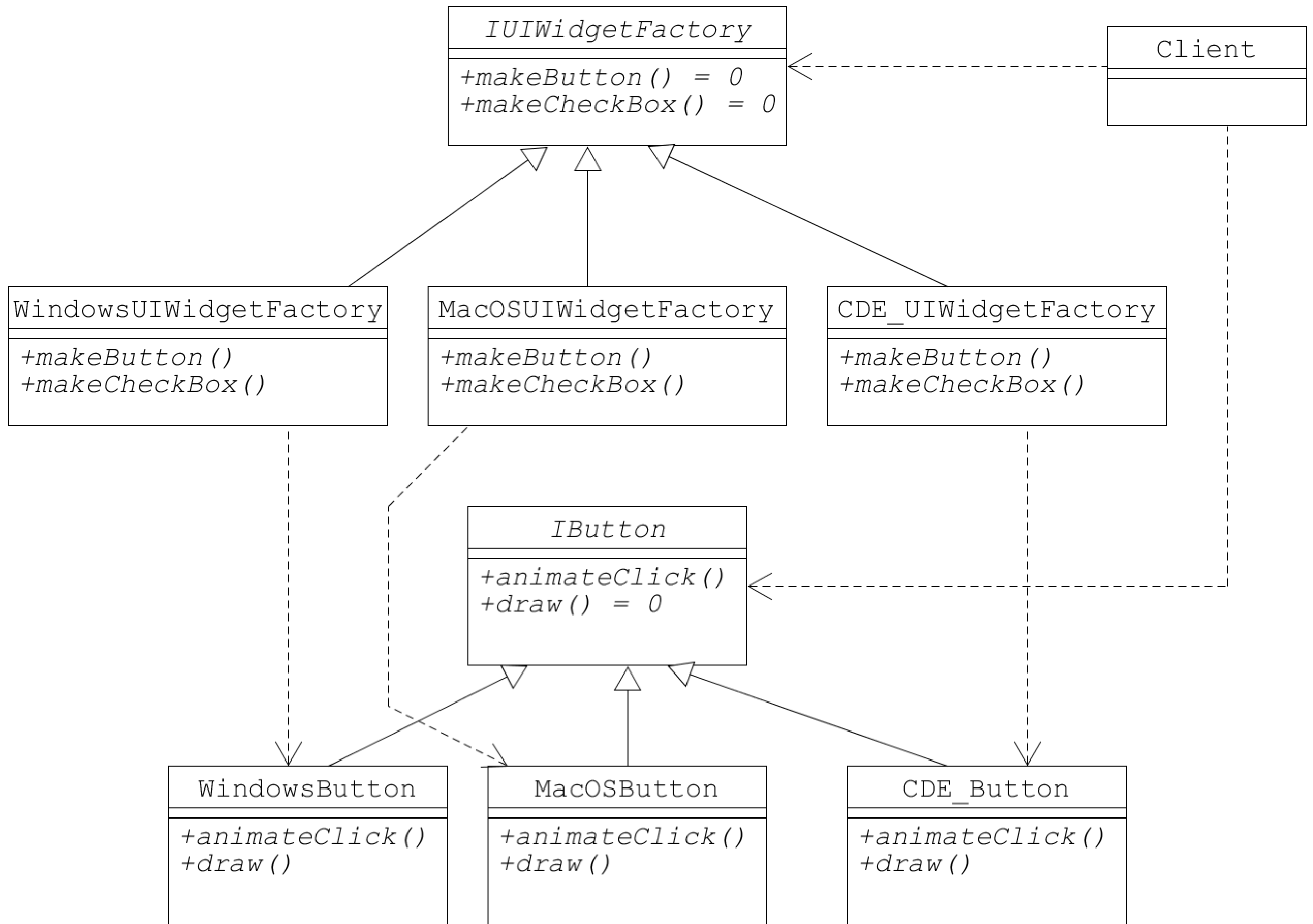
CDE/Motif



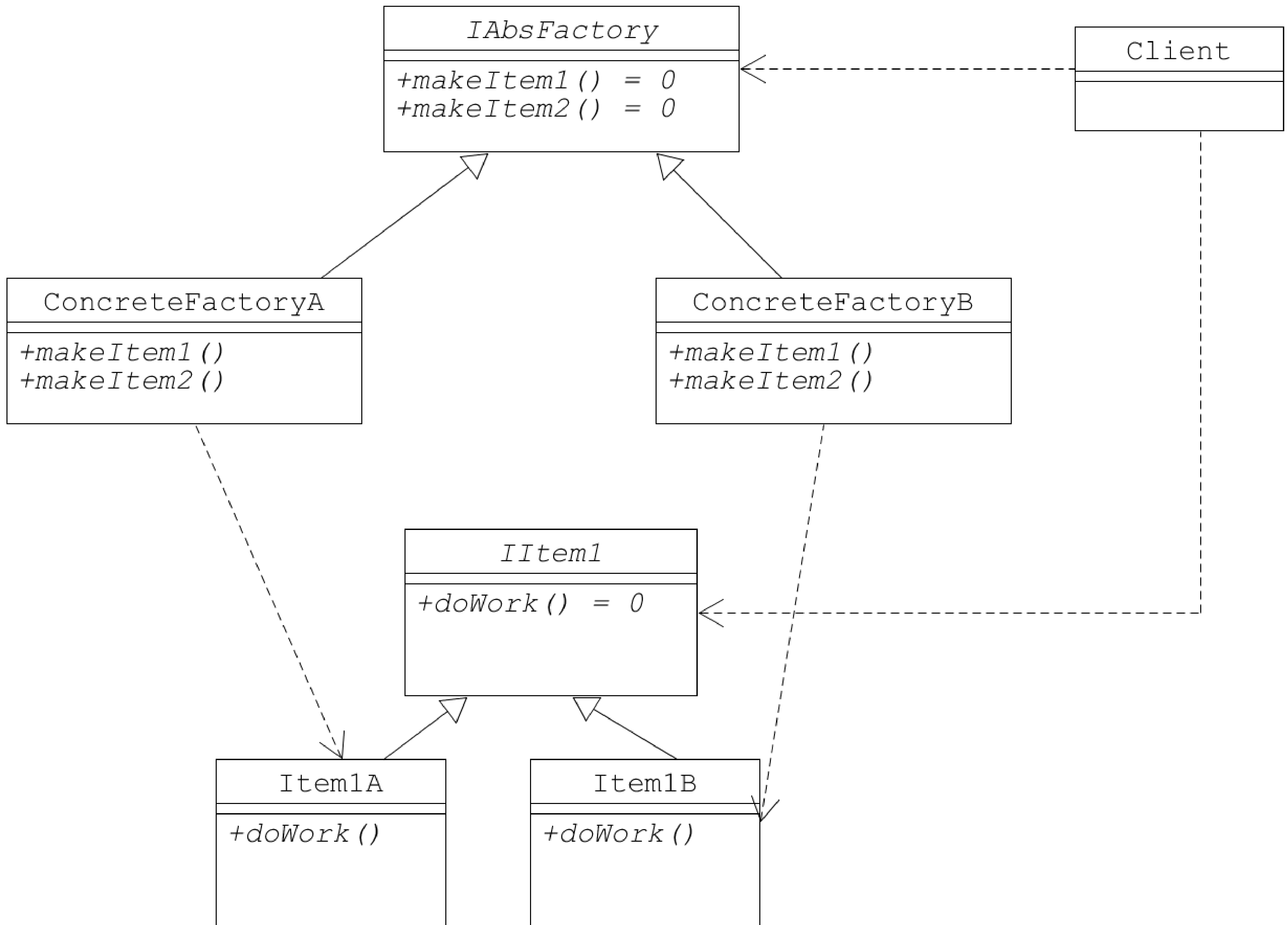
Windows



Nimbus/MacOS



adapted from Shalloway, p208


IAbsFactory
+makeItem1() = 0
+makeItem2() = 0
Client
ConcreteFactoryA
+makeItem1()
+makeItem2()
ConcreteFactoryB
+makeItem1()
+makeItem2()
IItem1
+doWork() = 0
Item1A
+doWork()
Item1B
+doWork()