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Problem Solving Programming

Design Patterns

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Recap of Previous Lecture

Abstract Factory Design Pattern

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Abstract Factory Pattern Concept

GoF Definition

- Abstract Factory is a creational design pattern that lets you produce families of related objects without specifying their concrete classes.
- In this pattern, you provide a way to encapsulate a group of individual factories that have a common theme.
- This pattern helps you to interchange specific implementations without changing the code that uses them, even at runtime. However, it may result in unnecessary complexity and extra work.
- An abstract factory is called a factory of factories.

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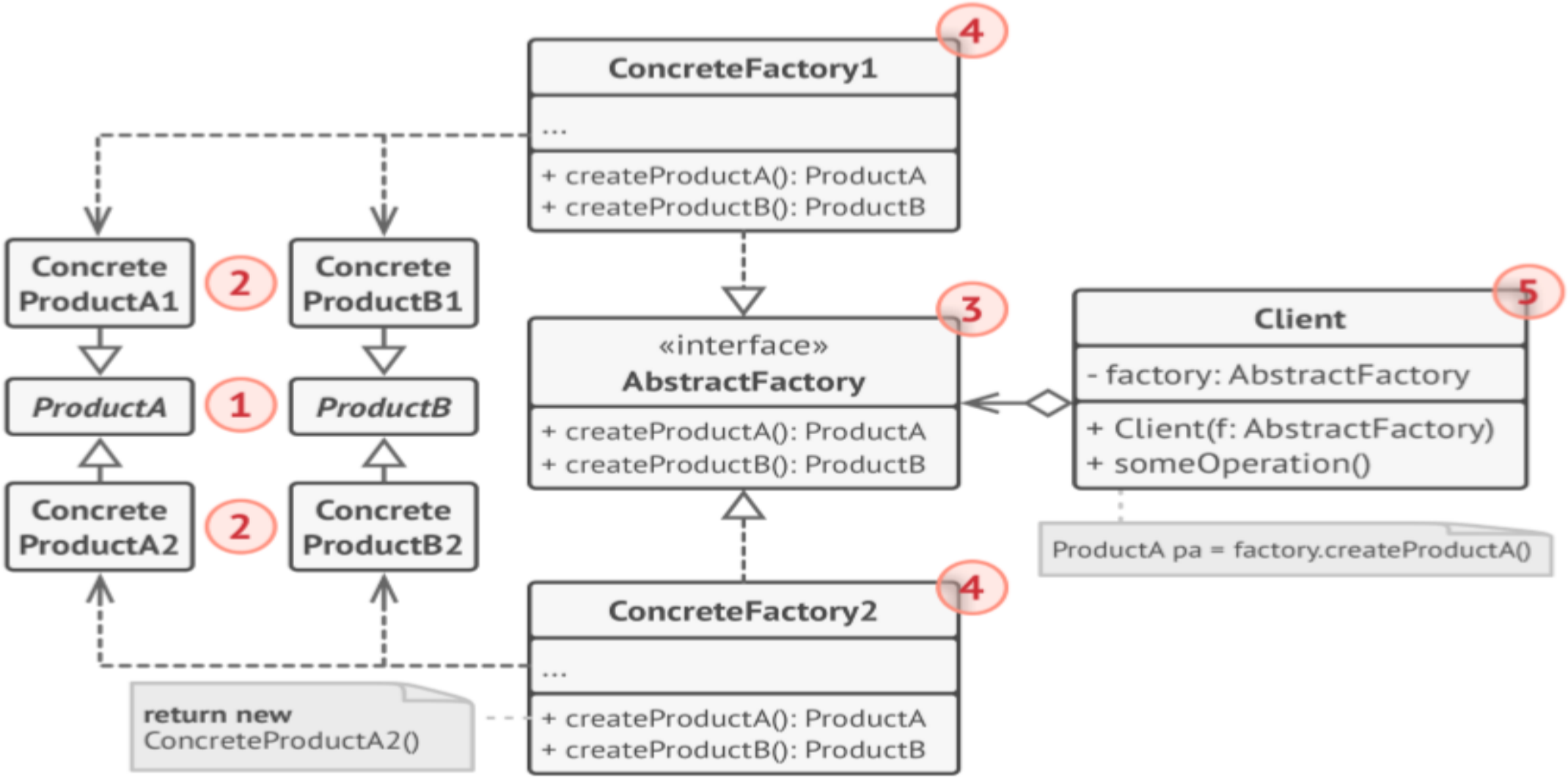
Abstract Factory Pattern Structure



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Disadvantages

- Code is complex.
- A lot of understanding is required.
- Difficult to implement.
- The most complex in creational patterns.
- Refactoring – Factory Method.
- Pattern within a pattern.

Video Lecture Link : http://203.124.40.59:5802/Videos

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Design Patterns Lecture - 16

Builder Pattern

- What is builder design pattern
- Implementation and Guideline
- Practical Implementation using C#

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Introduction

- The Builder Pattern is a common software design pattern that's used to encapsulate the construction logic for an object.
- This pattern is often used when the construction process of an object is complex.
- It's also well suited for constructing multiple representations of the same class.
- Let us first, go over the basics of the pattern, and then with code examples crystallize the concepts.

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What is Builder Design Pattern

The Concept

- **Builder** is a creational design pattern that lets you construct complex objects step by step. The pattern allows you to produce different types and representations of an object using the same construction code.
- Gang of Four Definition say:
  - Separates the construction of a complex object from its representation so that the same construction process can create different representations.
- Solves the problem of increasing constructor parameters and constructors of a given class by providing a step-by-step initialization of parameters.
- After step-by-step initialization, it returns the constructed object at once.

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Wikipedia:

- The builder pattern is a design pattern designed to provide a flexible solution to various object creation problems in object-oriented programming. The intent of the Builder design pattern is to separate the construction of a complex object from its representation. It is one of the Gang of Four design patterns.

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Implementation Guidelines

Choose builder pattern when:

- Need to breakup the construction of a complex object
- Need to build a complex object part-wise independently.
- Construction process must allow multiple representations of the same class.

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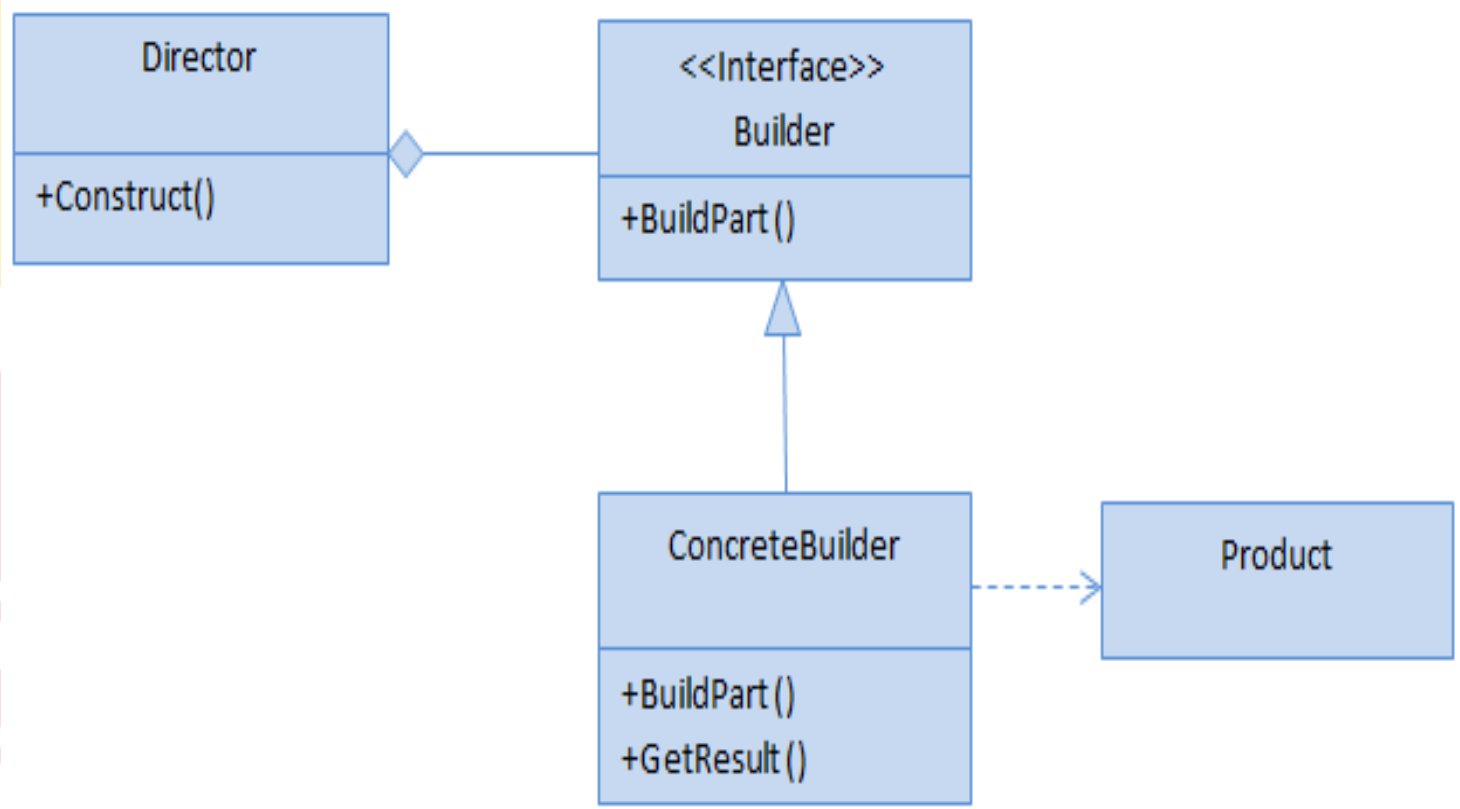
Builder Pattern Structure

The Structure

- Builder Interface
- Concrete Builder
- Product
- Director



Builder Pattern

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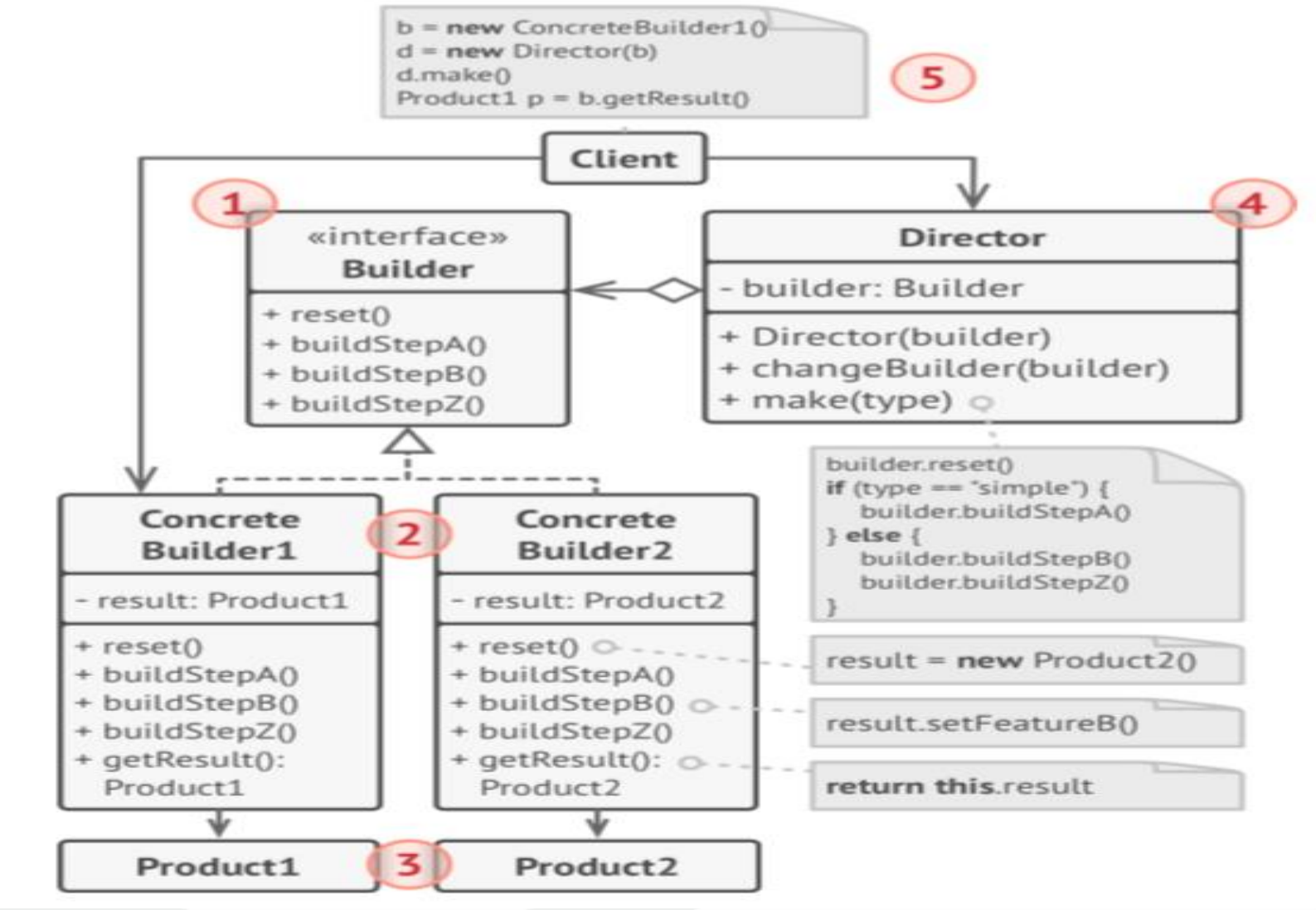
Builder Pattern Structure

The Structure

- Building Multiple Products Structure



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Participants of Builder Pattern

Builder

This is an interface which is used to define all the steps to create a product

Concrete Builder

This is a class which implements the Builder interface to create a complex product.

Product

This is a class which defines the parts of the complex object which are to be generated by the builder pattern.

Director

This is a class which is used to construct an object using the Builder interface.

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Problem

- Imagine a complex object that requires a laborious, step-by-step initialization of many fields and nested objects.
- Monstrous constructor with lots of parameters.
- Scattered all over the client code.
- How to build a simple house?

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Problem

- How to build a simple house?
- Four walls, a floor, install a door, fit a pair of windows, and build a roof.
- What about bigger house with backyard and swimming pool?
- What if we need a house with other representation like heating system, plumbing and networking cable installation?

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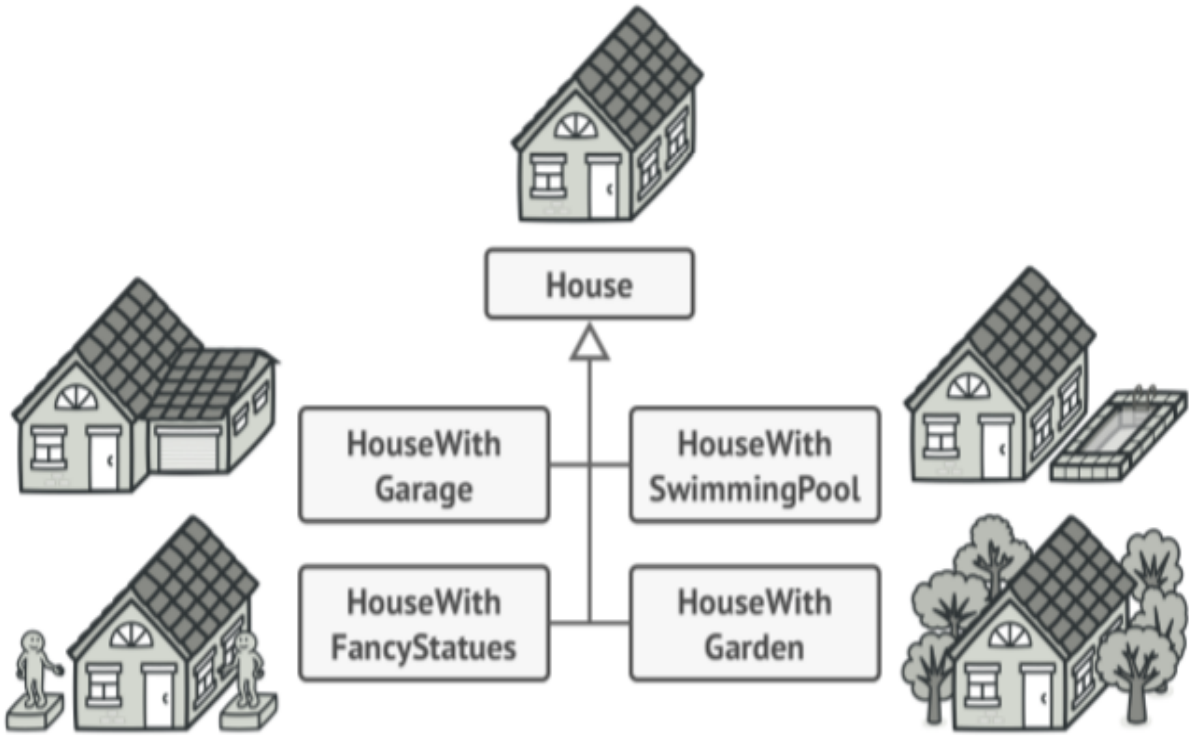
Solution using Inheritance

- A base class House
- Create other subclasses that will cover all combinations of parameters.
- This approach seems to end up with considerable number of subclasses.



You might make the program too complex by creating a subclass for every possible configuration of an object.

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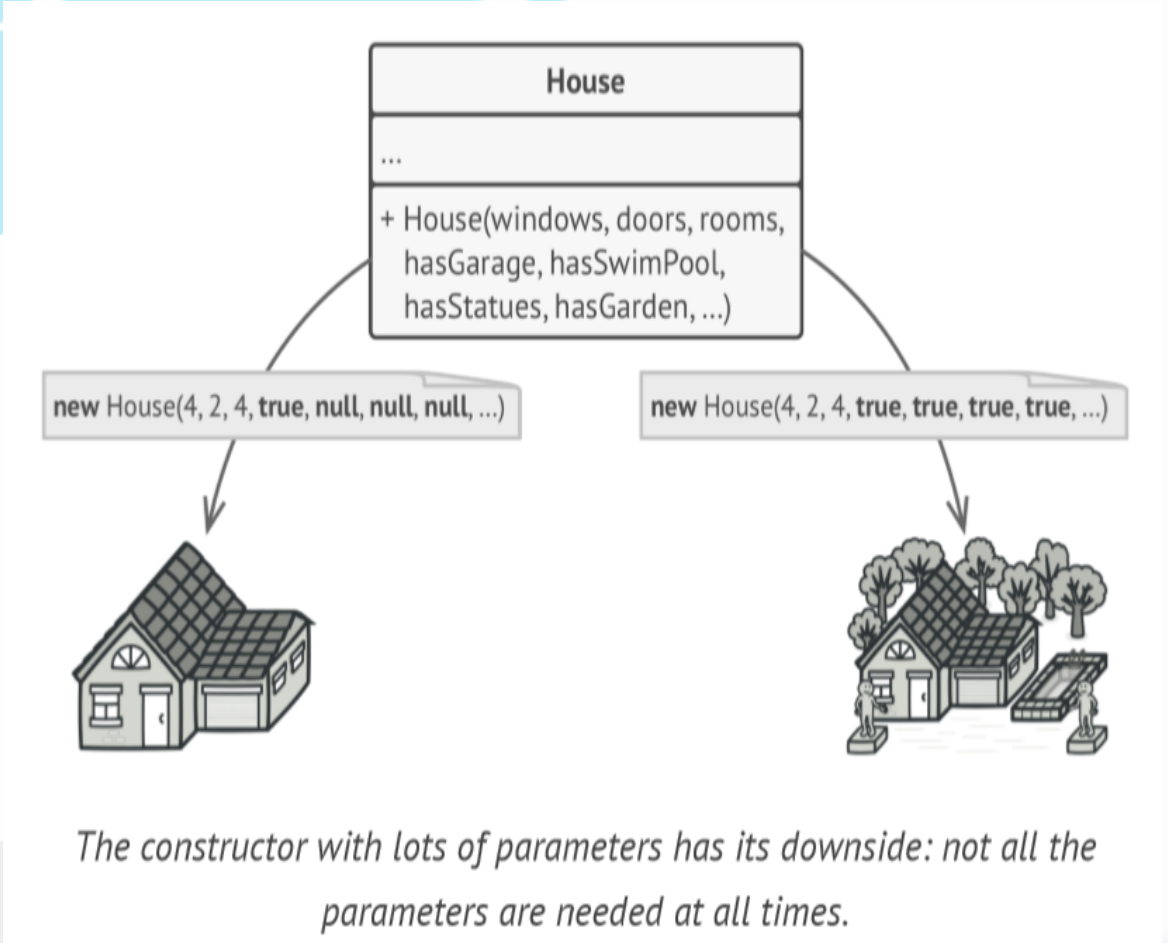
Solution using Method Parameters

- Create a giant constructor right in the base class.
- Provide all possible parameters in the constructor that control the house object.
- Breeding subclasses will be solved but another problem is born.
- In many cases most of the parameters will be unused.
- For instance, only a fraction of houses have swimming pools, so the parameters related to swimming pools will be useless nine times out often.



The constructor with lots of parameters has its downside: not all the parameters are needed at all times.

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Fast Food Restaurant Business Case

- A typical meal could be a burger and a cold drink.
- Burger could be either a Veg Burger or Chicken Burger and will be packed by a wrapper.
- Cold drink could be either a coke or Pepsi and will be packed in a bottle.
- *Item* interface represents food items such as burgers and cold drinks and concrete classes implement the *Item* interface and a *Packing* interface represents packaging of food items and concrete classes implement the *Packing* interface as burger would be packed in wrapper and cold drink would be packed as bottle.
- *Meal* class have *ArrayList* of *Item* and a *MealBuilder* to build different types of *Meal* objects by combining *Item*.
- *BuilderPatternDemo*, demo class will use *MealBuilder* to build a *Meal*.

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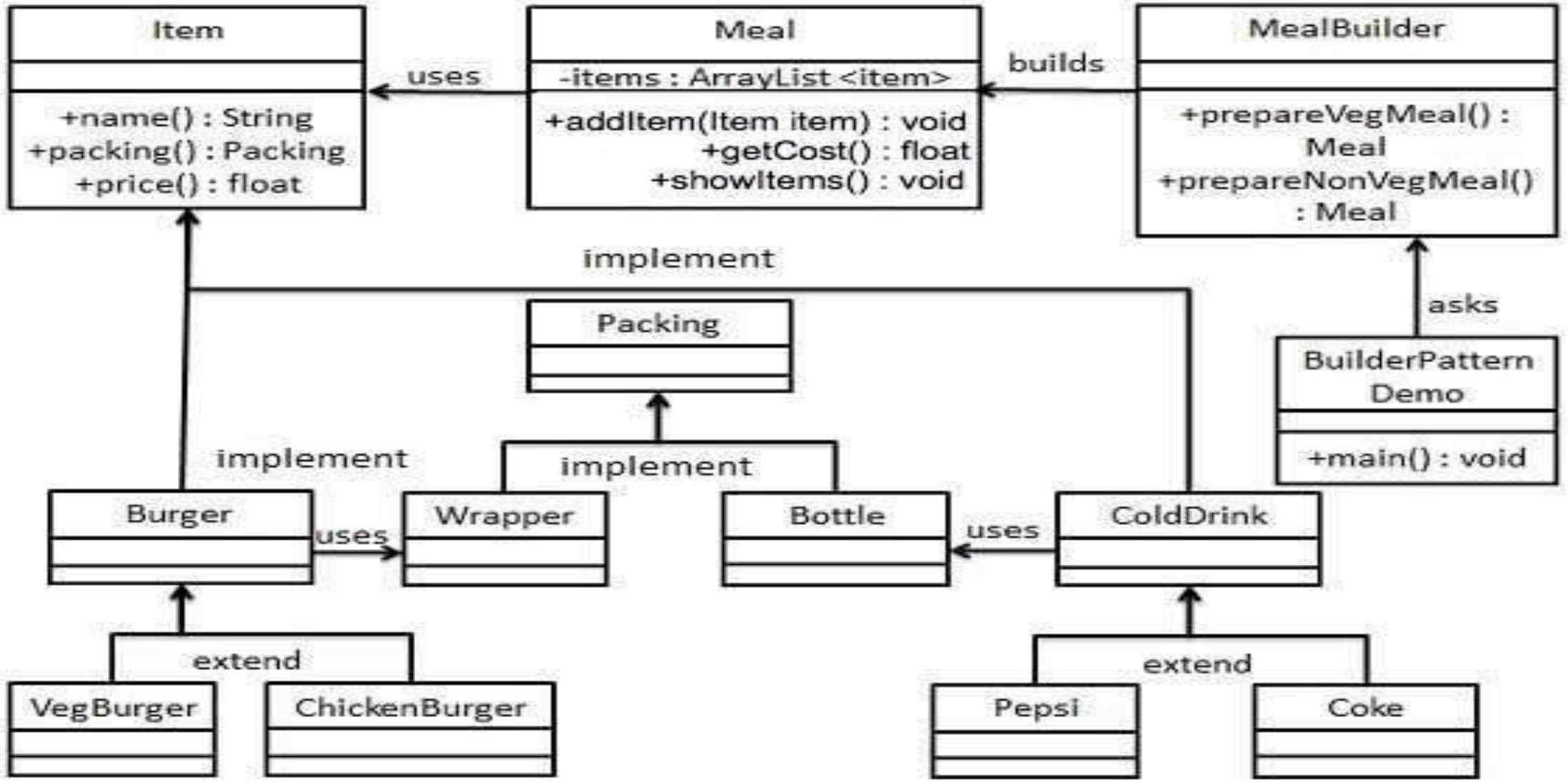
Fast Food Restaurant Business Case

Structure



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