University of Antwerp
Faculty of Applied Engineering

5-Software Design

Lab Session 4

06/11/2025

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Course Outline

Outline labs

- **Part A: UML diagrams**
  Sessions 1 – 2
- **Part B: Design Patterns**
  Session 3 – 5
- **Part C: Projects in groups of 2**
  Session 6 – 9

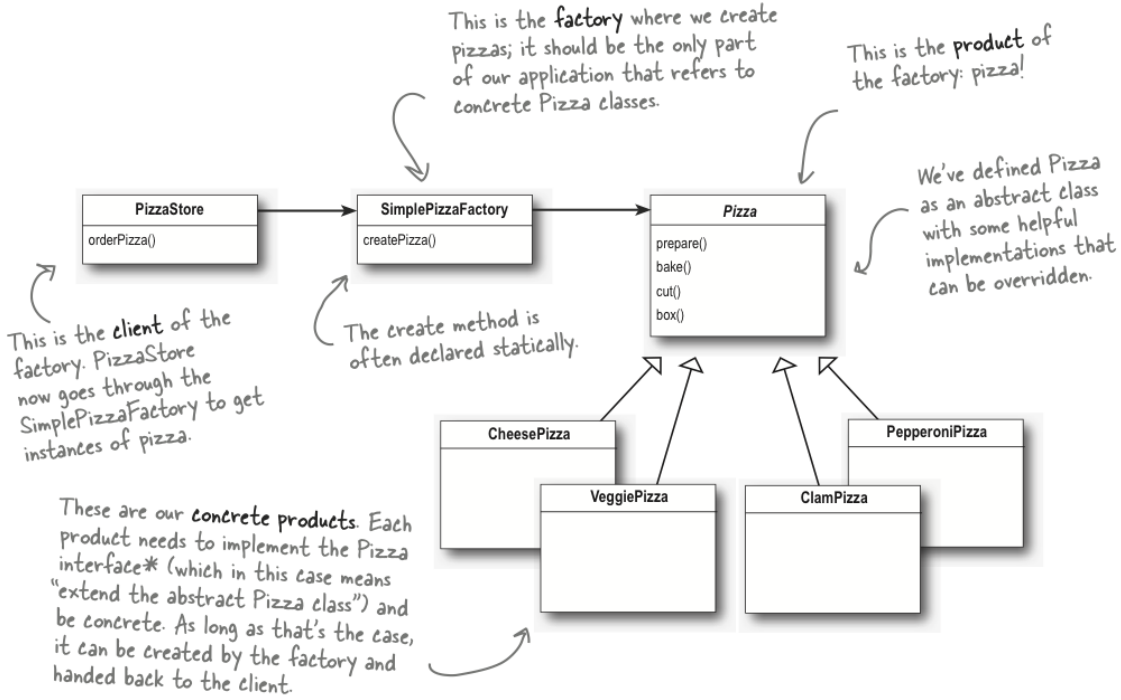
- **Evaluation:**
  - Entire portfolio: zip containing code, UML diagrams, AI usage
    - Submit before 7th lab at defined date
    - Oral defence
  - Defence of projects

Part B
Design Patterns

Factory & Abstract Factory Patterns

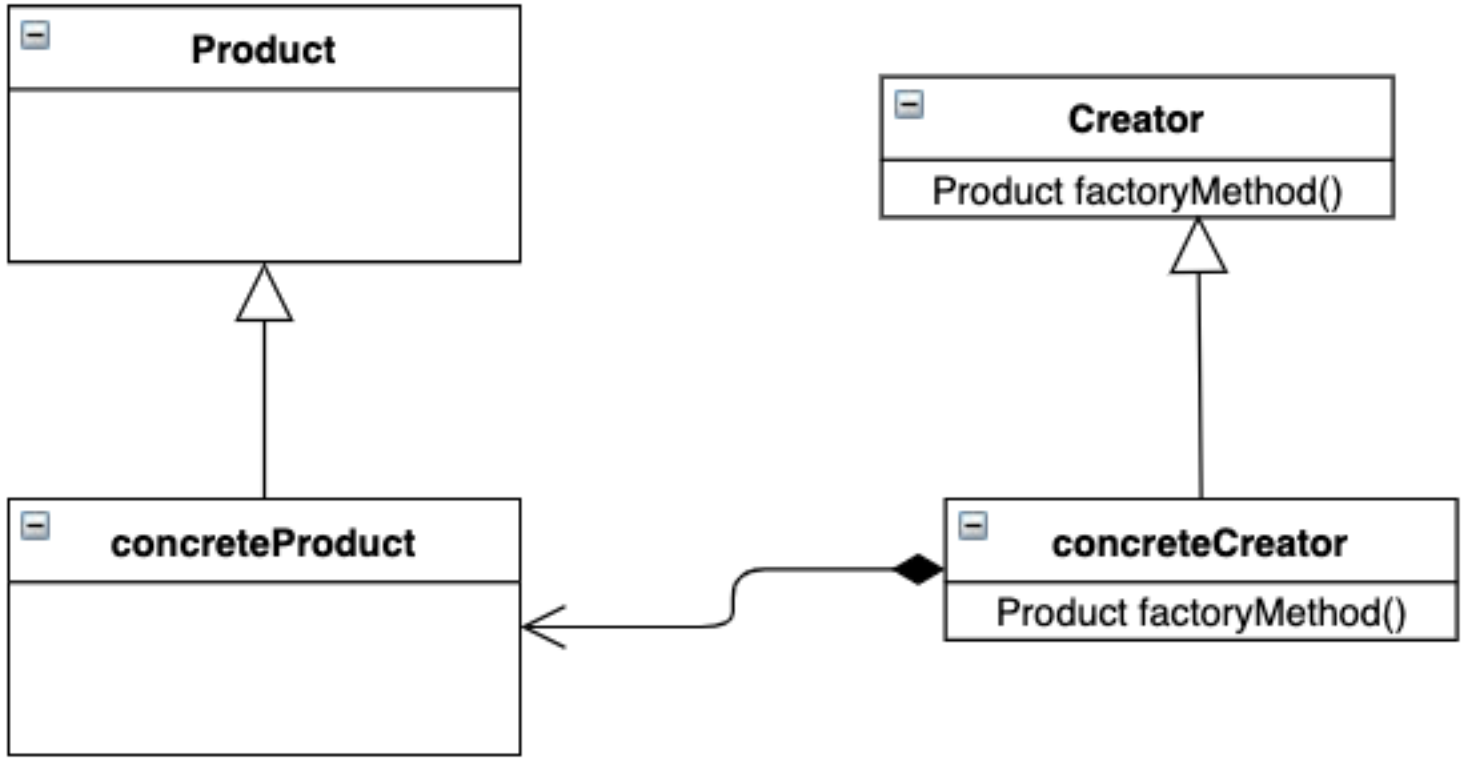
Simple Factory

- **The Simple Factory** is a commonly used **programming idiom**, not a pattern
- The Simple Factory **handles** the details of **object creation**



Factory Method

- **Factory Method** Pattern **defines an interface** for creating an object, but lets the **subclass decide** which class to instantiate



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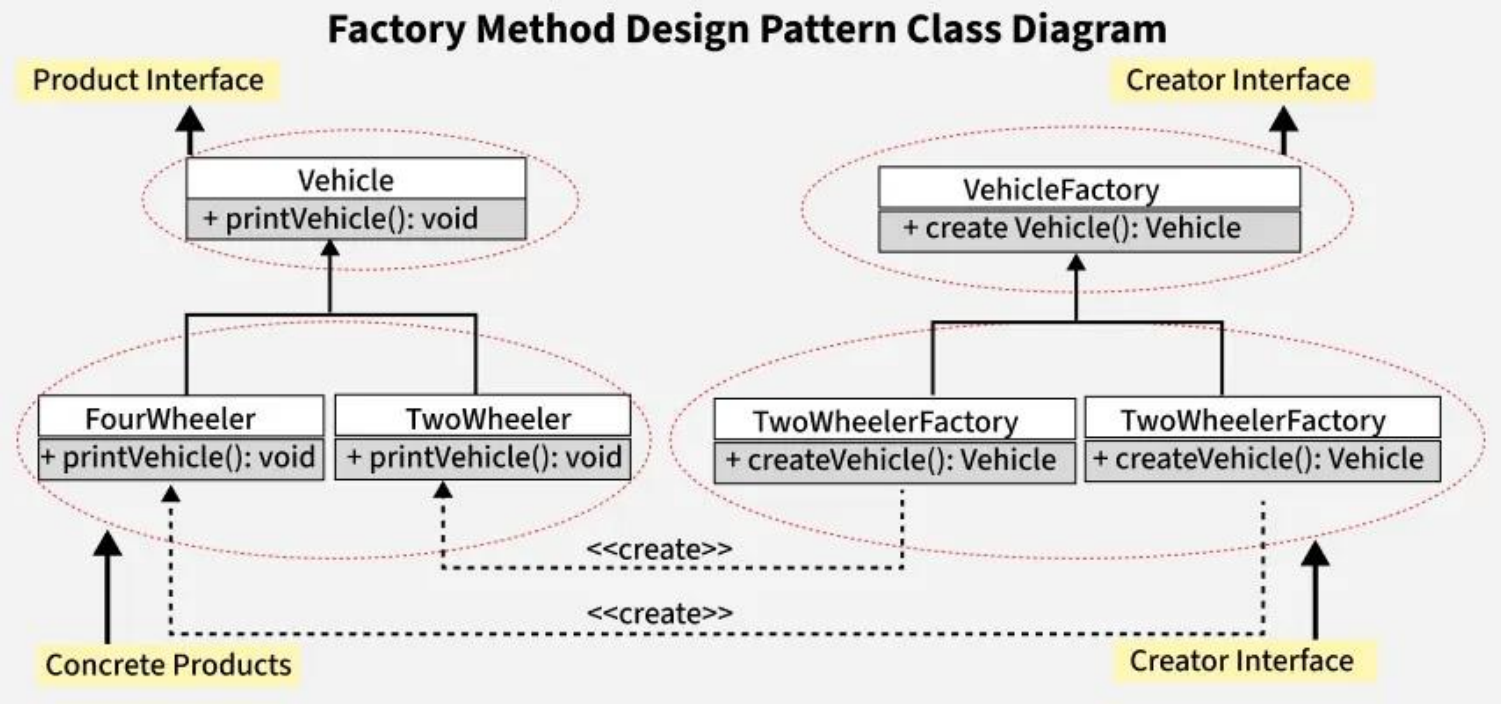
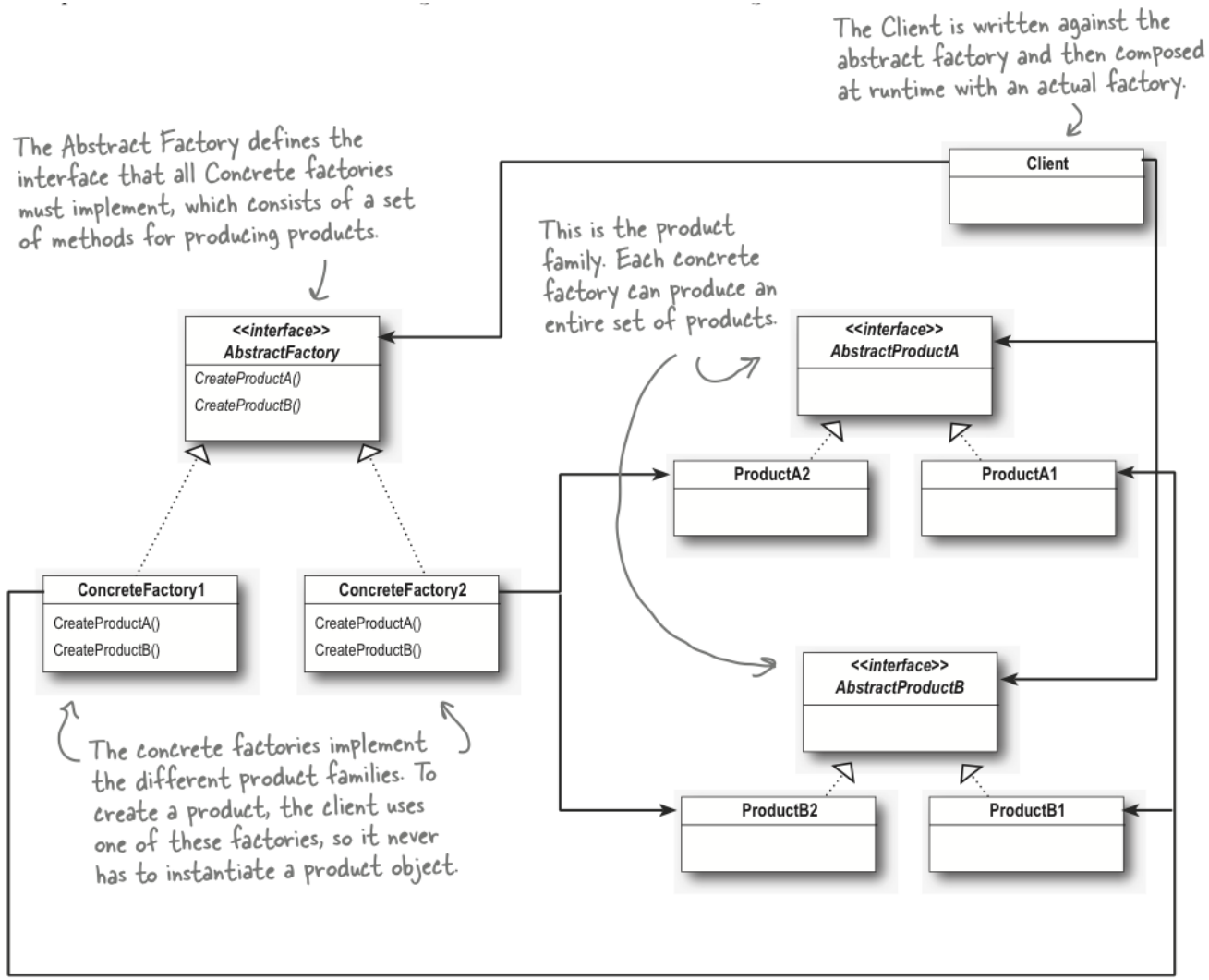


https://www.geeksforgeeks.org/system-design/factory-method-for-designing-pattern/

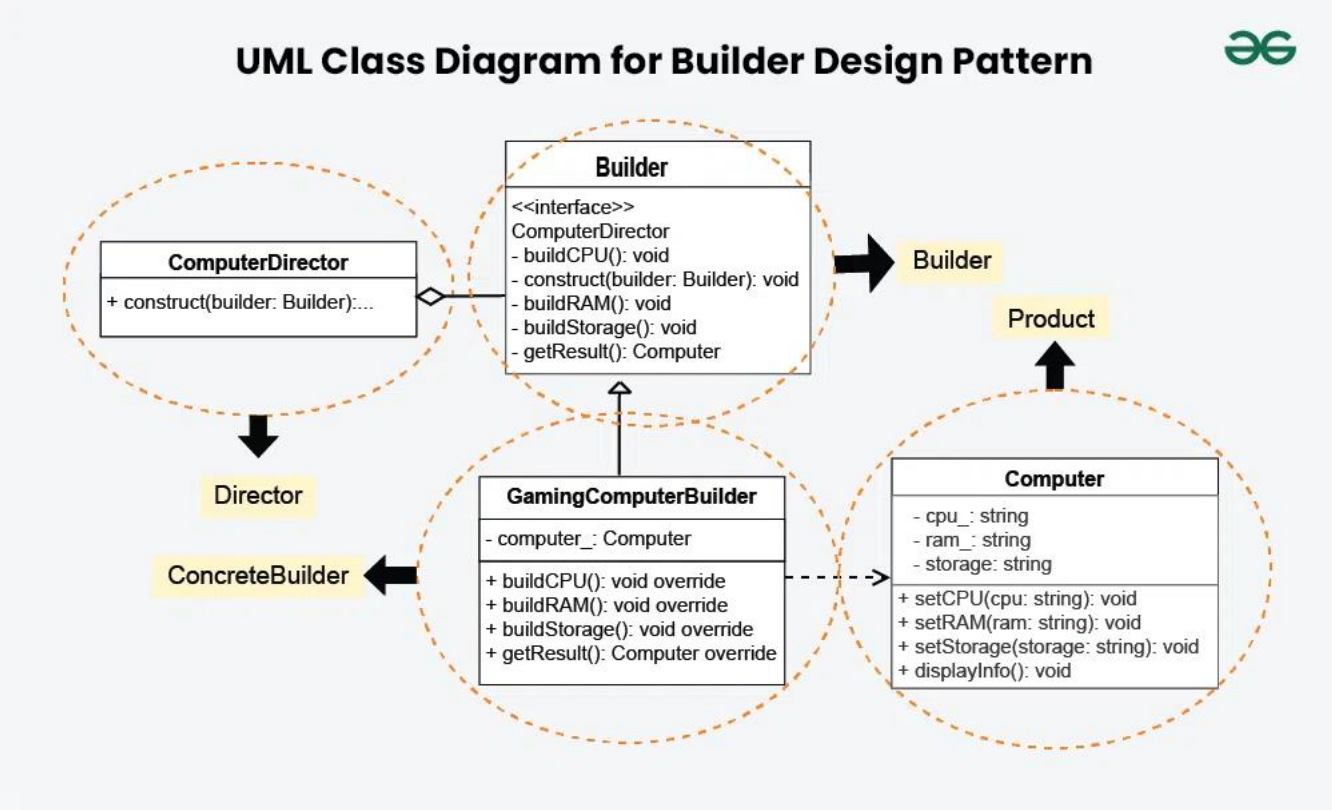
Abstract Factory

- **Factory** of **factories**
- Abstract Factory **provides an interface** for creating objects **without specifying their concrete classes**



Builder Pattern

- Creational Design Pattern
- Provides step-by-step approach to construct complex objects



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Assignments

Factory & Abstract Factory Patterns

Assignment part 1

Factory Method

You'll build a reforestation planner

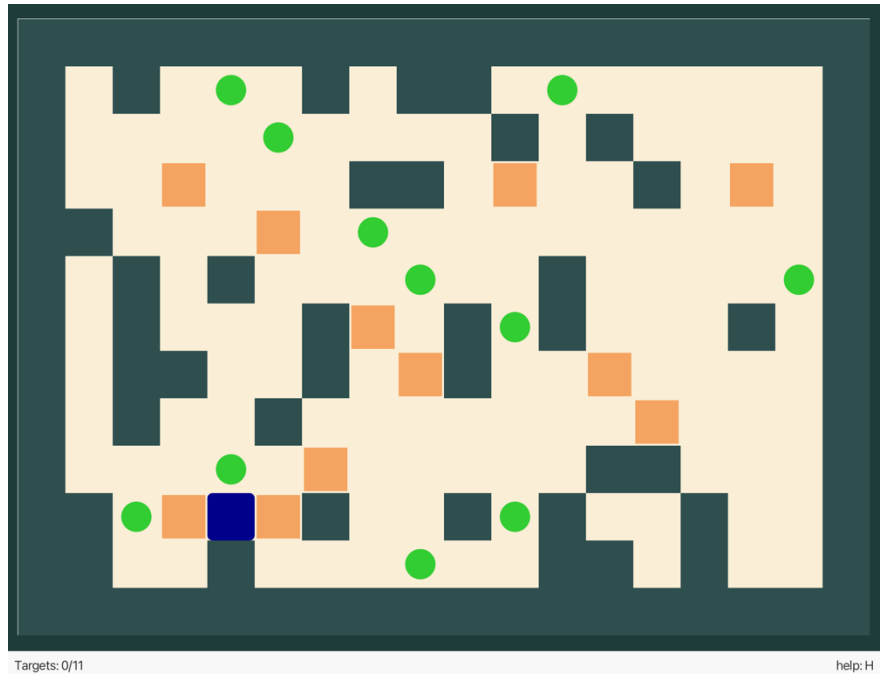
- Implement the Factory Method **ReforestationPlanner**
- Implement the **product classes**
- Implement the **concrete factories**
- Implement the **main method**
- **Create a class diagram**

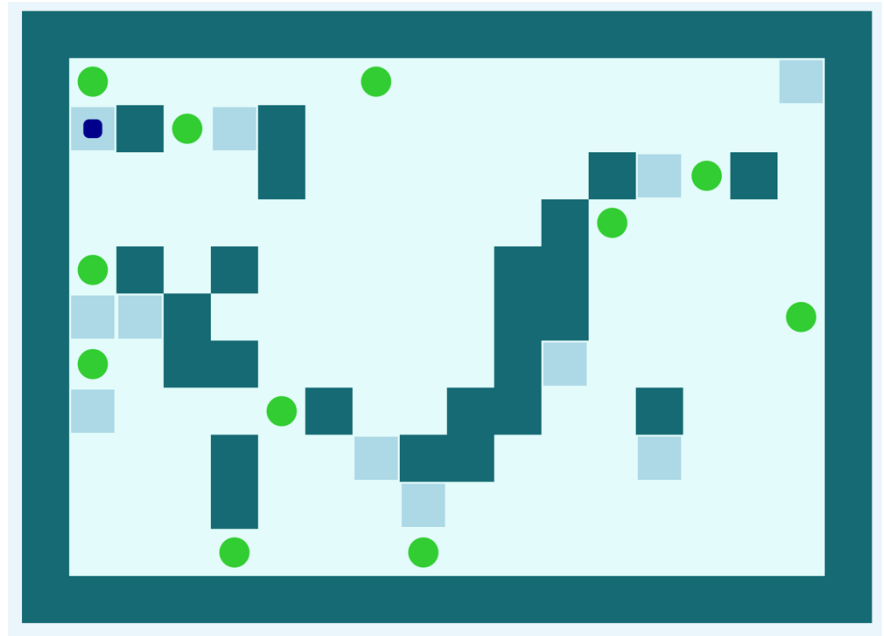
```
Reforestation of Antwerp:
Plant 1333 × Oak (loam, spacing ~3.0 m) on 1.2 ha (soil=loam)
Plant 2222 × Maple (loam, spacing ~3.0 m) on 2.0 ha (soil=loam)

Reforestation of East-Flanders:
Plant 5556 × Alder (wet, spacing ~2.0 m) on 5.0 ha (soil=clay)
Plant 1667 × Beech (well-drained, spacing ~3.0 m) on 1.5 ha (soil=clay)

Reforestation of West-Flanders:
Plant 4960 × Pine (sandy, spacing ~2.5 m) on 3.1 ha (soil=sandy)
Plant 1280 × Willow (wet, spacing ~2.5 m) on 0.8 ha (soil=wet)
Plant 6500 × Spruce (acidic, spacing ~2.0 m) on 2.6 ha (soil=loam)
```

Assignment part 2

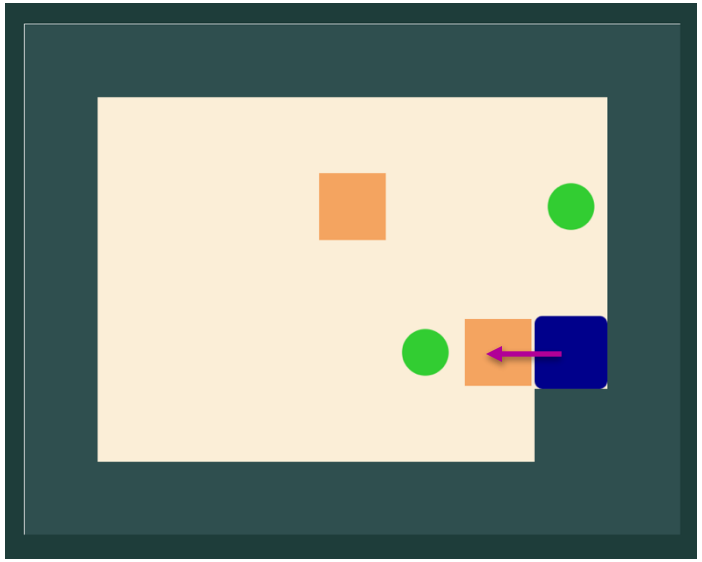
Sokoban Game

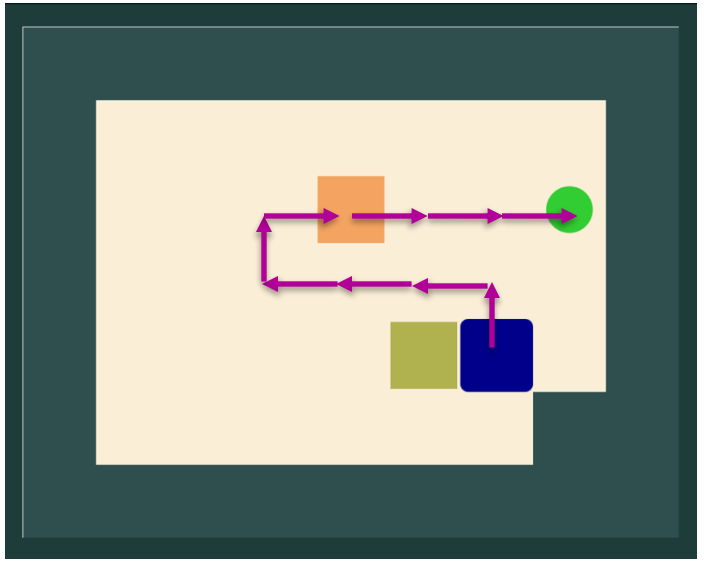
- **Puzzle Game**
  - Goal: all boxes on the correct (green) position
- **2 Game modes**
  - Warehouse (normal Sokoban)
  - Glacier (special rules)
- **Movement**
  - All directions
    - Warehouse: 1 step
    - Glacier: slide until wall/box

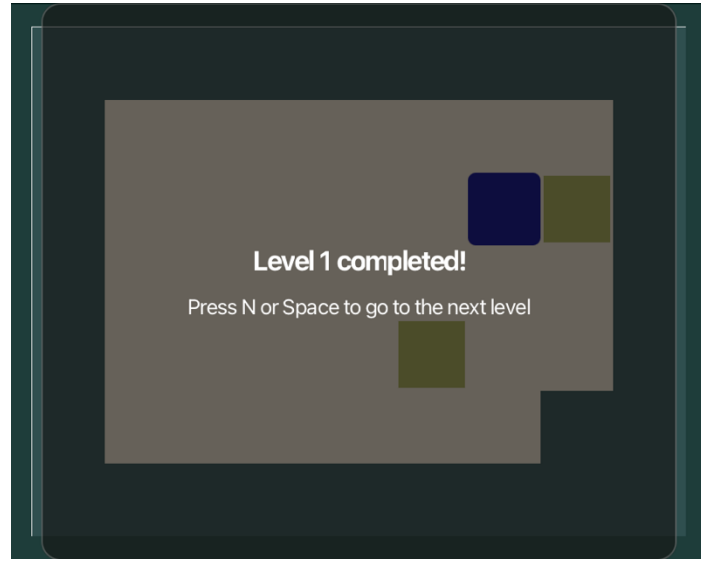




Assignment part 2







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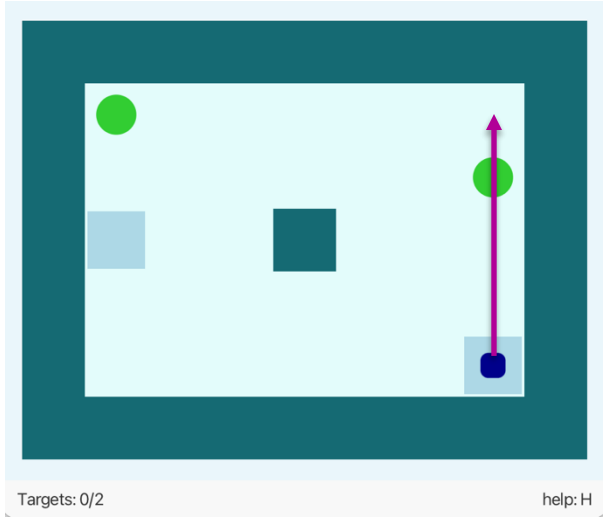

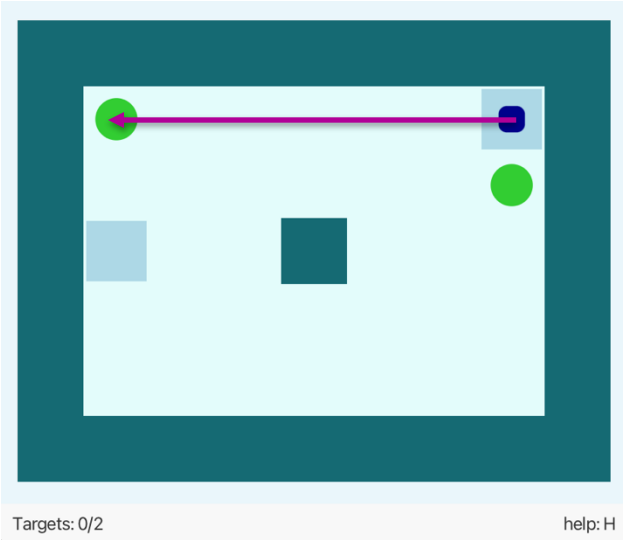

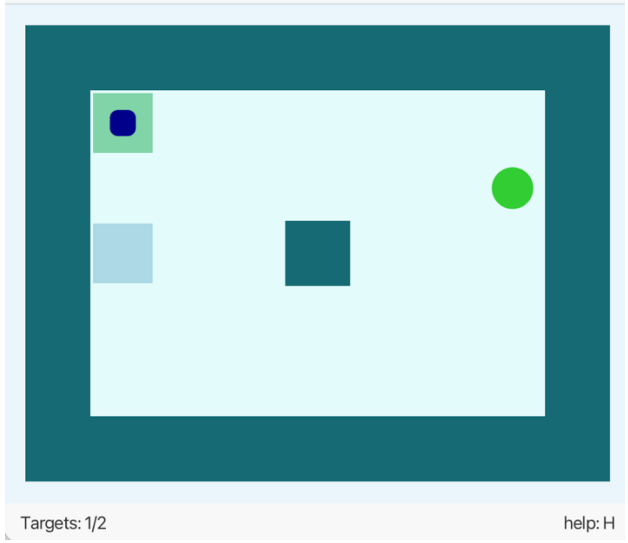

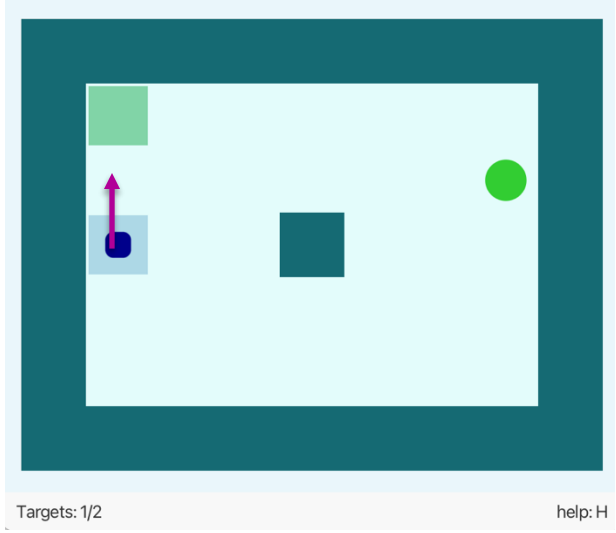

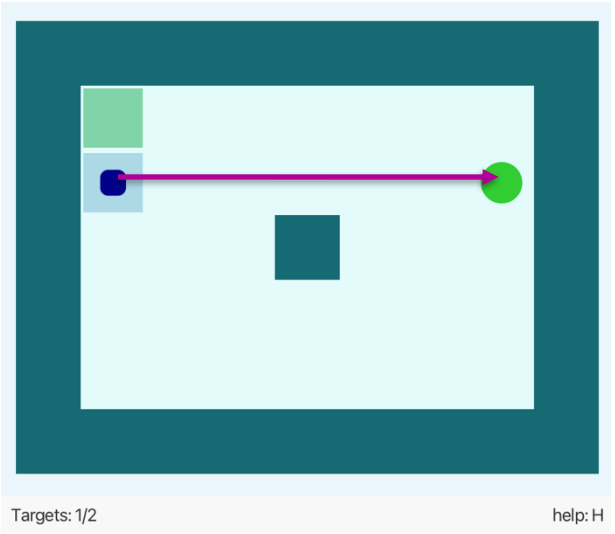

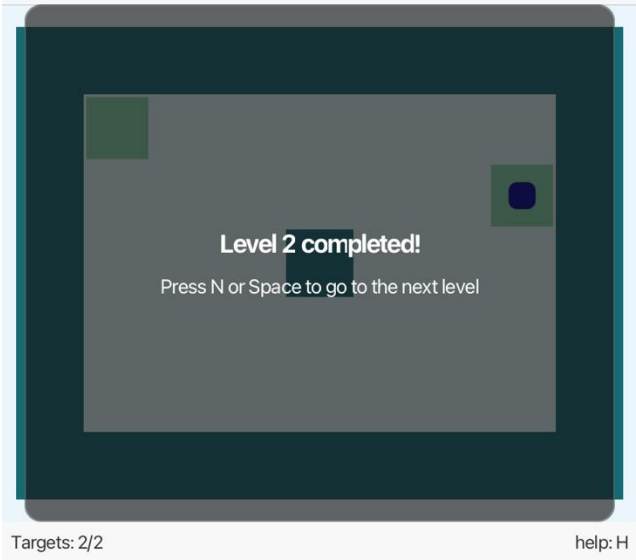

Assignment part 2

Sokoban Game

- Implement the Builder Pattern
- Implement the Builder Director
- Implement the Abstract Factory
- Implement the Concrete Factories
- Implement the concrete products