Assignment 06: Behavioral Design pattern (10%)

Assignment Overview:

In this assignment, you will be tasked with implementing the State and Template Method design patterns to model a simplified vending machine system. The vending machine will have different states representing its operational modes, and it will follow a specific process for dispensing products.

Problem Description: You are hired by a vending machine company to develop a software system for their new vending machines. The vending machine has the following states:

1. **Idle State:** The initial state when the machine is not in use.
2. **Selection State:** The state when a product is selected by the user.
3. **Dispensing State:** The state when the product is being dispensed.
4. **OutOfStock State:** The state when the selected product is out of stock.

The vending machine offers various products such as soda, chips, candy, etc. Each product has a specific price and availability. When a product is selected, the machine checks if it's in stock and if the user has inserted enough money to purchase it. If the product is available and there's enough money, it dispenses the product; otherwise, it returns the money or displays an out-of-stock message.

Assignment Tasks:

Task 1: State Design Pattern Implementation

Implement the State design pattern to model the different states of the vending machine. Each state should encapsulate the behavior corresponding to its state. Create classes for each state (IdleState, SelectionState, DispensingState, OutOfStockState) that implement a common State interface.

Task 2: Template Method Design Pattern Implementation

Implement the Template Method design pattern to define the process for dispensing products in the vending machine. Create a template class named ProductDispenserTemplate that outlines the steps of the dispensing process. Define abstract methods for steps such as checking product availability, verifying payment, and dispensing the product. Subclasses for specific products (e.g., SodaDispenser, ChipsDispenser) should implement these abstract methods according to the requirements of each product.

Task 3: Integration and Testing

Integrate the State and Template Method patterns into the vending machine system. Create a VendingMachine class that manages the states and the dispensing process using these patterns. Test the vending machine system by simulating various scenarios such as selecting different products, inserting money, and handling out-of-stock situations.

Deliverables:

Source code files (.cs) implementing the State and Template Method patterns.

A brief report documenting the design decisions and patterns used in the implementation.
Test cases demonstrating the functionality of the vending machine system.
Submission Guidelines: Submit your assignment by [submission date] via [submission platform]. Include all the necessary source code files and the report documenting your design decisions and testing results.

Evaluation Criteria:
Your assignment will be evaluated based on the following criteria:
Correct implementation of the State and Template Method design patterns.
Adherence to design principles such as encapsulation, abstraction, and modularity.
Effectiveness of the vending machine system in handling different scenarios.
Clarity and completeness of the documentation and test cases.

The deadline is 10 days from the posting date. It will be on the 18th of April 2024.