Atılm University
Department of Software Engineering

SE461 Software Design Patterns
Fall, 2021-2022
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Assignment 3
Due Date: December 22, 2021 23.59
Duration: 7 Days

WARNINGS
- Students who either cheat, attempt to cheat or provide a help to other(s) in cheating (based on JPlag), get 0 (zero) grade from assignment. Also, based on the regulations, a disciplinary action will be taken.
- For every late hour, 10 points will be cut.
- Assignments sent by e-mail will not be accepted.

In this assignment you are going to implement a program which performs series of operations on a number. You will create operations, attach operations to an expression, construct a statement from these operation – expression pairs, and evaluate the statement.

Given the following `CommandPatternMain.java` starting point code:

```java
package se461.hw3;

public class CommandPatternMain {
  public static void main(String[] args) {
    Expression expression = new Expression();
    Operation integrationOperation = new IntegrationOperation(expression, 0.01, 5);
    Operation diffOperation = new DifferentiationOperation(expression, 0.01, 5);

    Statement statement = new Statement();
    statement.appendOperation(integrationOperation);
    statement.appendOperation(diffOperation);
    statement.evaluate();

    System.out.println(expression.getCurrentValue());
    }
}
```

IntegrationOperation(Expression expression, double dx, double nextValue);

DifferentiationOperation(Expression expression, double dx, double nextValue);

1. (10 points) By looking this main code, fill the blanks (you can use annotation feature of your PDF viewer):

   _____ is a command interface.

   _____ is a concrete command.

   _____ is a concrete command.

   _____ is the receiver.

   _____ is the invoker.

   _____ is the client.

2. (20 points) Draw a UML Class Diagram for your **Command Pattern** based proposed design which is suitable for use with above main code (include CommandPatternMain in your diagram).

3. (70 points) Implement your design by using with Java or C++.

HINTS:

An integration operation can be implemented as:

```
expression.updateSum(expression.getCurrentValue() + (this.nextValue * this.getDx());
```
nextValue is the new value to be add in the integration, getDx method returns a very small value like 0.01.

A differentiation operation can be implemented as:

```
expression.updateSum((this.nextValue - expression.getCurrentValue()) / (this.getDx()));
```
nextValue is the new value 0.01 unit distant to the currentValue, getDx method returns a very small value like 0.01.

NOTES:

If you find any non-clear parts in the assignment, you can make reasonable assumptions about them and implement according to your assumptions.

Your programs will be evaluated by both following your UML Class Diagrams and the answer key. Therefore, make sure to follow your UML Class Diagrams while implementing your proposed solution.

Upload this file after completing the question 1, your class files, and your UML Class Diagram as SVG or high-res PNG. You can compress your files as a ZIP file.