N11: Plastic Number

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Chapter 1

Introduction

1.1 Value

The Plastic number is known as the Plastic constant or Plastic ratio.

The value of the Plastic number is

$$\rho = \sqrt[3]{\frac{9+\sqrt{69}}{18}} + \sqrt[3]{\frac{9-\sqrt{69}}{18}} \tag{1.1}$$

Its decimal representation begin with 1.32471.[1]

1.2 Uses

It can be a way of partitioning a square into three rectangles.

A Rectangle of aspect ratio ρ^2 can be used for dissections of a square into similar rectangles [1]

Figure 1.1: Three partitions of a square into similar rectangles

Chapter 2

Interview

2.1 Questions & Answers

Q: What are the operators do you use in a calculator?
A: I use all the operators.

Q: What do you dislike about a calculator?
A: I don't like writing long equations in a calculator.

Q: How often do you use a calculator?
A: I use a calculator every day for my physics problems.

Q: Do you like to use your mind to do the calculation or to use a calculator?
A: It depends, if the calculation is easy, then I would use my mind, however, if the number is more than 4 digits, then I would use a calculator.

Q: What constants do you want to have in a calculator?
A: I would like the calculator to have all possible constants since I like to have precise calculations for my experiments. for example: Pi,e,...

Q: Do you prefer a console or GUI calculator?
A: I would prefer to use MATLAB.

Q: What are the functions do you wish to have in a calculator and didn't you find it yet?
A: Custom log base, Usually in calculators, you can only do ln and log, But log to the base 3 is not available.

Q: Have you ever had a bad experience with a calculator?
A: Accidentally, I pressed the erase button, so I needed to re-enter everything again.

Q: Do you like a calculator to plot a graph?
A: Yes

Q: do you prefer a real or soft calculator?
A: A real one, It's easy to carry it.

Q: Have you ever heard about the plastic number?
A: Yes.

Q: what is the application for that number?
A: it is used in Geometry; it can be used to partition a square into three rectangles.

Q: Finally, what are your recommendations?
A: I would recommend having a calculator with a large display, and it can plot a graph.

2.2 Analysis

Based on the conducted interview, a calculator is one of the most important assets for a mathematician as he/she can perform complex calculations. Most of the mathematicians use a lot of irrational numbers and they preferred to have them all in the calculator, the user also preferred to have a way to save the equation if he accidentally press the clear button so he/she doesn't need to reenter it again and also the user prefers the calculator to have the option to plot a graph.

Chapter 3

User Persona

P. Tran Tuan

Demographics

Age 19

Occupation Undergraduate Student

Location Russia

University Moscow State University

About

Young and ambitious student with the ability to prove it.

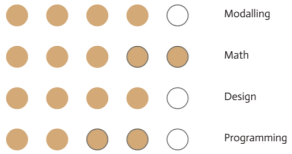
Sociable, friendly and easygoing person.

Not into parties

Tasks

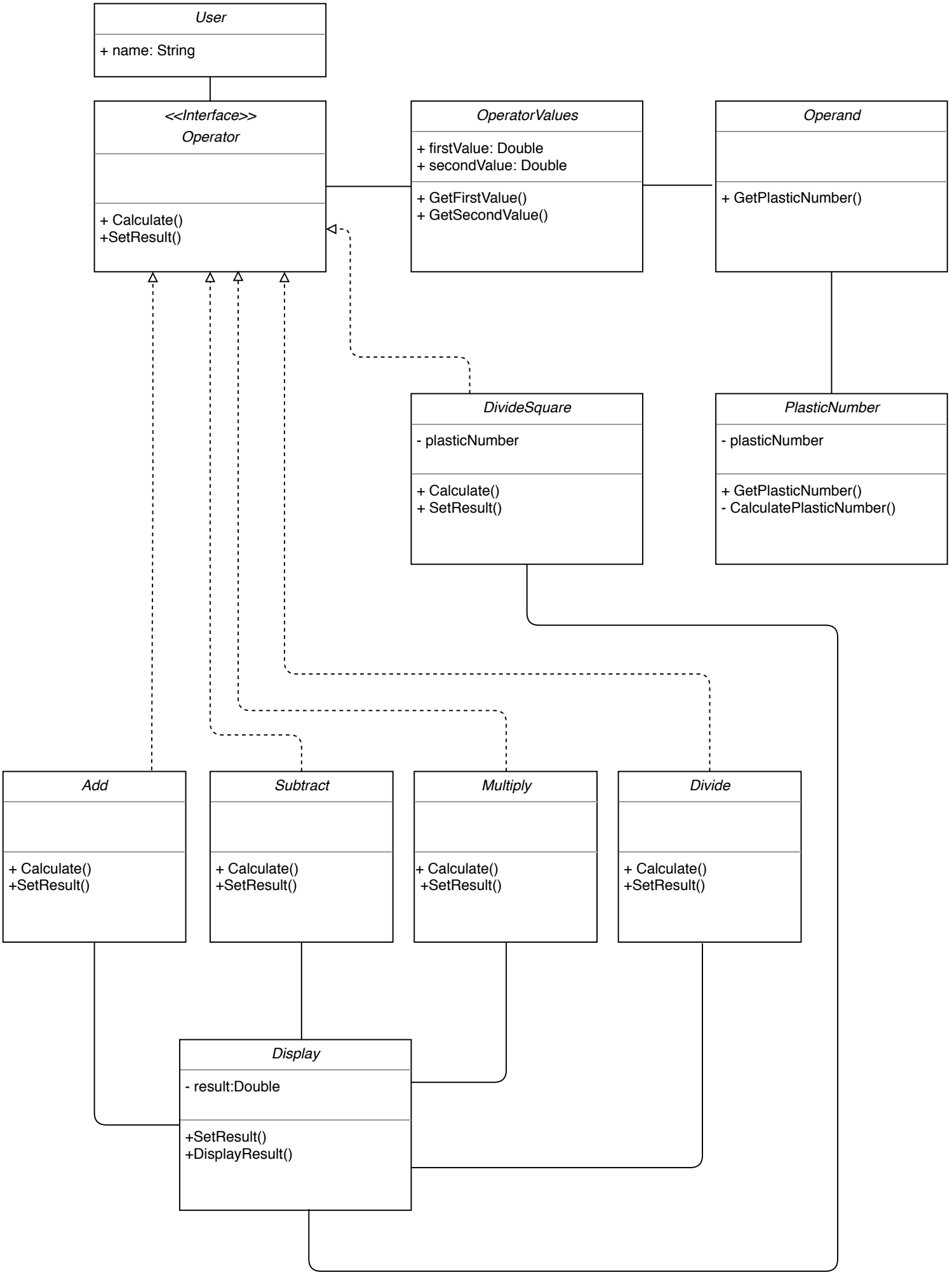
- Program Optimization
- Resources Management
- Load Balancing

Skills



Chapter 4

Problem Domain


User
+ name: String
<<Interface>>
Operator
+ Calculate()
+SetResult()
OperatorValues
+ firstValue: Double
+ secondValue: Double
+ GetFirstValue()
+ GetSecondValue()
Operand
+ GetPlasticNumber()
DivideSquare
- plasticNumber
+ Calculate()
+ SetResult()
PlasticNumber
- plasticNumber
+ GetPlasticNumber()
- CalculatePlasticNumber()
Add
+ Calculate()
+SetResult()
Subtract
+ Calculate()
+SetResult()
Multiply
+ Calculate()
+SetResult()
Divide
+ Calculate()
+SetResult()
Display
- result:Double
+SetResult()
+DisplayResult()

4.1 Description

A calculator has 5 operators which are Add, Subtract, Multiply, Divide and Divide Square.

4.1.1 User

A user is a person who is using the calculator.

4.1.2 Operator

A user can use an operator to perform his calculation.

The Operator class is an interface class.

4.1.3 OperatorValues

The OperatorValues class shall be used to get the first and second value from the user.

4.1.4 Operand

Operand class shall be used to get all the irrational number.

4.1.5 PlasticNumber

PlasticNumber is used to calculate the plastic number and also return the value of it.

4.1.6 DivideSquare

The DivideSquare class shall implement the operator interface by dividing the square area by the plastic number and then display it.

4.1.7 Add

The Add class shall implement the operator interface by adding the two numbers and then display it.

4.1.8 Subtract

The Subtract class shall implement the operator interface by subtracting the two numbers and then display it.

4.1.9 Multiply

The Multiply class shall implement the operator interface by Multiply the two numbers and then display it.

4.1.10 Divide

The Divide class shall implement the operator interface by Dividing the two numbers and then display it.

4.1.11 Display

The Display class shall display the result after performing the calculation

Chapter 5

Activity Diagram

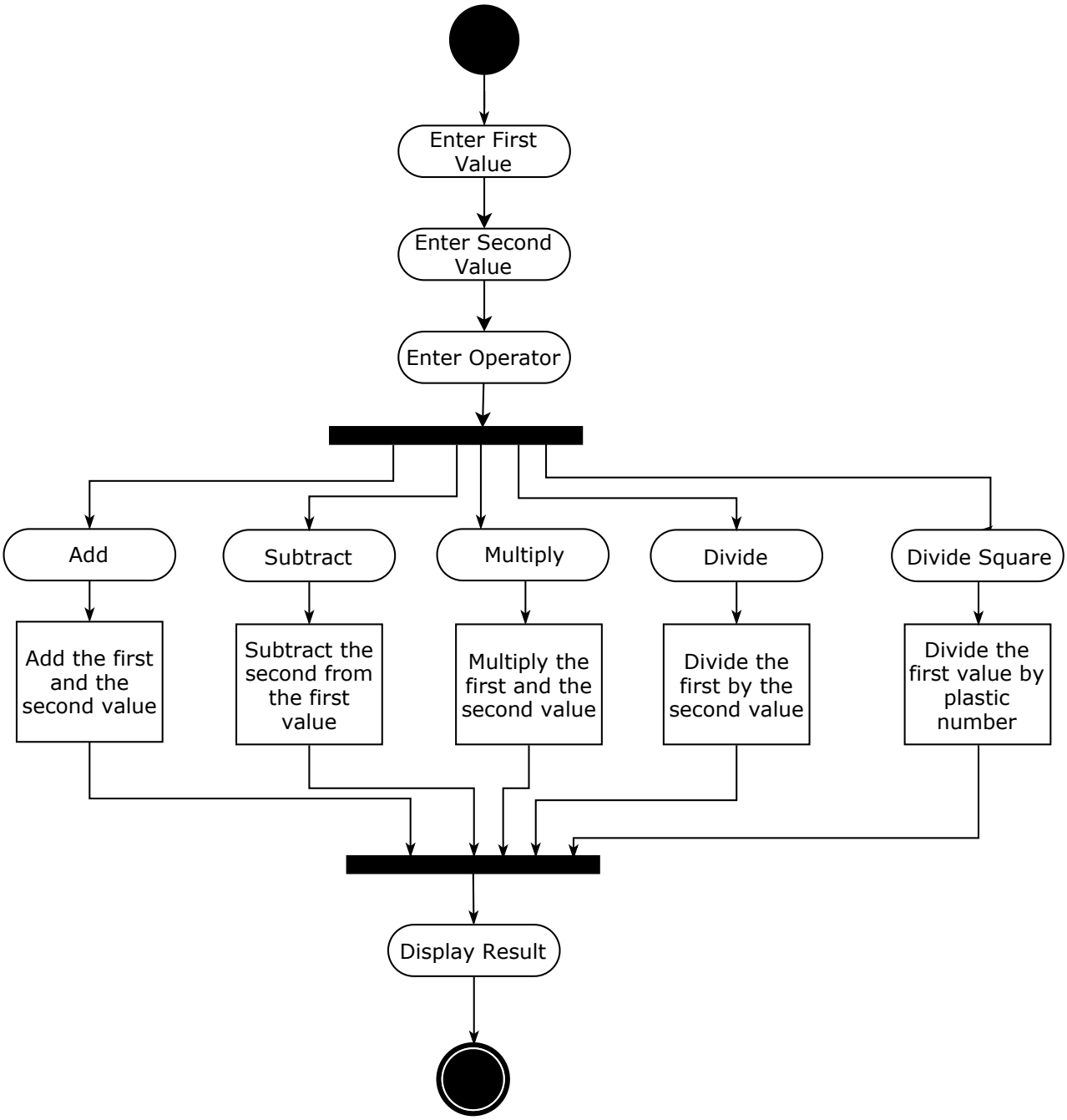
5.1 Description

The user shall enter the first, second value and the operator that he wants to perform.

The next activity will be based on the operator that has been entered in the previous step.

- If the user selects the "Add" function then the first and second values will be added
- If the user selects the "Subtract" function then the second will be subtracted from the first number.
- If the user selects the "Multiply" function then the first and second values will be Multiplied
- If the user selects the "Divide" function then the first will be divided by the second number
- If the user selects the "Divide Square" function then the first will be divided by plastic number.

Finally, after performing the calculation the results shall be displayed.


Enter First Value
Enter Second Value
Enter Operator
Add
Subtract
Multiply
Divide
Divide Square
Add the first and the second value
Subtract the second from the first value
Multiply the first and the second value
Divide the first by the second value
Divide the first value by plastic number
Display Result

Chapter 6

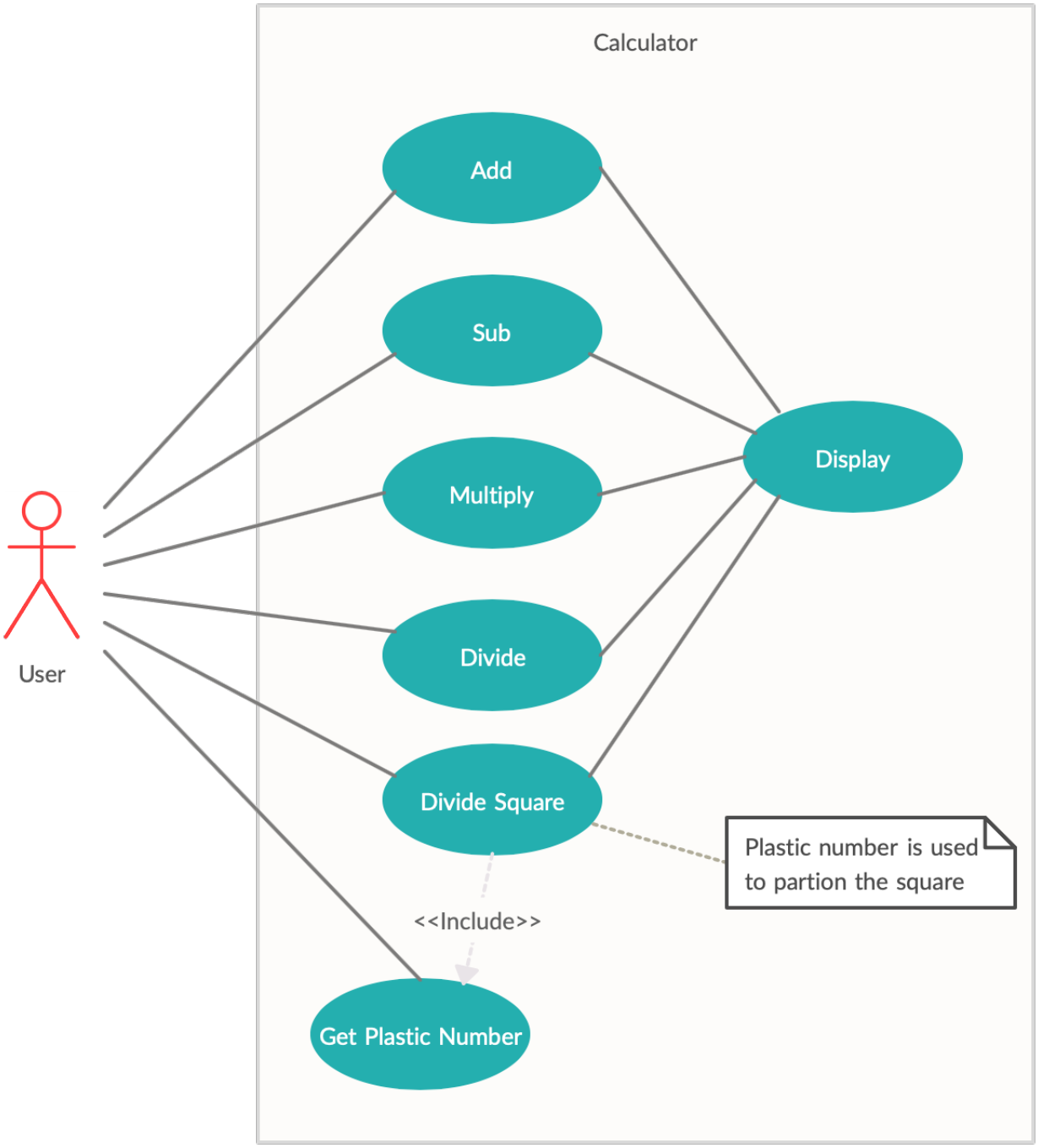
Use Case Diagram

6.1 Description

The user has 6 use cases, each one has a unique goal as follow:

- The goal of the "Add" Use case is to add the two numbers.
- The goal of the "Sub" Use case is to subtract the two numbers.
- The goal of the "Multiply" Use case is to Multiply the two numbers.
- The goal of the "Divide" Use case is to divide the two numbers.
- The goal of the "Divide Square" Use case is to partition the square.
- The goal of the "Get Plastic Number" Use case is to add two numbers.

Finally, the goal of the "Display" use case is to display the results of the calculation.


Calculator
Add
Sub
Multiply
Divide
Divide Square
Display
Get Plastic Number
<<Include>>
Plastic number is used to partion the square
User

Bibliography

[1] *Plastic number. (2019, June 02). Retrieved from https://en.wikipedia.org/wiki/Plastic*$_n$*umber.*